2014 REQUEST FOR INFORMATION

Section 368 Energy Corridors

RFI date: March 28, 2014

2014 Request for Information

On March 28, 2014, the Department of the Interior (DOI), Bureau of Land Management (BLM), the U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS), and the Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability (OE) (collectively, the Agencies) published a Request for Information (RFI) to solicit information from interested stakeholders related to the West-wide Energy Corridor Review. The Agencies sought information to assist them in the development of the Section 368 Corridor Study and to provide the foundation for the Regional Reviews. Specifically, the Agencies requested responses to the questions below:

- Are there any new or updated spatial data that is publicly available?
- Are there any other types of projects that the Agencies should consider to assess use of Section 368 Corridors?
- Are there methods the Agencies should consider using to evaluate the effectiveness of the IOPs?
- Is there any other publicly available information that the Agencies should consider as part of the initial Regional Periodic Review, including review of the IOPs, and if so, where or how can it be found, and what parts of it are relevant to this RFI?
- Are there any laws, regulations, or other requirements that have been implemented since issuance of the DOI and FS RODs in January 2009 that the Agencies should consider when reviewing Section 368 Corridors?
- Are there any additional regional stakeholder fora that the Agencies should consider for stakeholder engagement during Regional Periodic Reviews?
- Are there any additions, deletions, or revisions the Agencies should consider making to the IOPs that were adopted in the DOI and FS RODs, and what is the rationale for those changes?
- The Agencies have committed to consideration of new IOPs submitted by the Plaintiffs who are parties to the Settlement. The new IOPs are available at http://corridoreis.anl.gov. Are there any comments on these new IOPs?

This document contains all of the written stakeholder input received in response to the 2014 RFI. This input was used to prepare the Corridor Study and is being used to develop corridor abstracts and Agency recommendations as part of the Regional Reviews.

Federal Register / Vol. 79, No. 60 / Friday, March 28, 2014 / Notices 17567

Resort, (6 miles south of Hagerman), 18734 Hwy–30, Hagerman, ID 83332.

FOR FURTHER INFORMATION CONTACT: Heather Tiel-Nelson, Twin Falls District, Idaho, 2536 Kimberly Road, Twin Falls, Idaho, 83301, (208) 736–2352.

SUPPLEMENTARY INFORMATION: The 15-member RAC advises the Secretary of the Interior, through the Bureau of Land Management, on a variety of planning and management issues associated with public land management in Idaho. The purpose of the April 23rd tour is to give RAC members an in depth look at the process a livestock grazing permittee follows to fulfill the parameters of their grazing permit.

Additional topics may be added and will be included in local media announcements. More information is available at *www.blm.gov/id/st/en/res/resource_advisory.3.html.* RAC meetings are open to the public.

Dated: March 19, 2014.

James Stovall,

District Manager (Acting).

[FR Doc. 2014–06907 Filed 3–27–14; 8:45 am]

BILLING CODE 4310–GG–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

DEPARTMENT OF AGRICULTURE

Forest Service

DEPARTMENT OF ENERGY

[14X L1109AF LLWO300000 L14300000 PN0000]

Request for Information: West-Wide Energy Corridor Review

AGENCY: Bureau of Land Management, Interior; Forest Service, USDA; Office of Electricity Delivery and Energy Reliability, DOE.

ACTION: Notice.

SUMMARY: The U.S. Department of the Interior (DOI), Bureau of Land Management (BLM); U.S. Department of Agriculture, U.S. Forest Service (FS); and the U.S. Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability, are seeking the information described in this notice related to the West-wide Energy Corridor Review.

DATES: Comments must be submitted by May 27, 2014.

ADDRESSES: You may submit comments electronically to *368corridors@blm.gov.* Entire comments, including any personal identifying information, may be made publicly available upon request. While respondents may request that personal identifying information be withheld from the public, the BLM, FS, and DOE (Agencies) cannot guarantee that they will be able to do so.

FOR FURTHER INFORMATION CONTACT: Stephen Fusilier, BLM, at 202–912–7426 or by email at *sfusilie@blm.gov.* Persons who use a telecommunications device for the deaf may call the Federal Information Relay Service at 800–877–8339 to contact Mr. Fusilier during normal business hours. The FIRS is available 24 hours per day, 7 days per week. You will receive a reply during normal business hours.

SUPPLEMENTARY INFORMATION: On August 8, 2005, the President signed into law the Energy Policy Act of 2005 (EPAct) (42 U.S.C. 15801 *et seq.*). In Section 368 of the EPAct (42 U.S.C. 15926), Congress directed the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior (the Secretaries) to designate corridors for oil, gas, and hydrogen pipelines and electrical transmission and distribution facilities on Federal lands in the 11 contiguous Western states (Section 368 Corridors). The Secretaries were also directed to perform any environmental reviews required to complete the designation of Section 368 Corridors, incorporate the Section 368 Corridors into land use plans, and establish a process for identifying new Section 368 Corridors.

On January 14, 2009, the DOI approved a record of decision (ROD) that amended 92 BLM land use plans and designated approximately 5,000 miles of Section 368 Corridors on BLM-administered lands. The affected States are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The FS issued a ROD on January 14, 2009, which amended 38 FS land use plans and designated approximately 990 miles of Section 368 Corridors on National Forest System lands in 10 states. Both RODs adopted mandatory interagency operating procedures (IOP) for projects sited within the Section 368 Corridors.

On July 7, 2009, several nonprofit organizations filed a complaint in the United States District Court for the Northern District of California, *Wilderness Society* v. *United States Department of the Interior,* No. 3:09-cv-03048–JW, challenging the DOI and FS RODs pursuant to the EPAct, National Environmental Policy Act, Endangered Species Act, and the Administrative Procedure Act.

On July 11, 2012, the court approved a settlement agreement (Settlement) and dismissed the case. The Settlement set forth five provisions with the objective of ensuring that future Section 368 Corridor revisions, deletions, and additions consider the following principles: Location of Section 368 Corridors in favorable landscapes; facilitation of renewable energy projects where feasible; avoidance of environmentally sensitive areas to the maximum extent practicable; diminution of the proliferation of dispersed rights-of-way crossing the landscape; and improvement of the long-term benefits of reliable and safe transmission. The Settlement also provides that public input and an open and transparent process with engagement by tribes, States, local governments, and other interested parties occur as part of the process for making potential revisions, deletions, or additions to Section 368 Corridors.

Two of the Settlement provisions are relevant to this RFI: (1) Preparation of regional periodic reviews of designated Section 368 Corridors (Regional Periodic Reviews) and reviews of IOPs; and (2) Development of a corridor study to assess the overall usefulness of the Section 368 Corridors (Section 368 Corridor Study). Information referenced in this RFI can be found at *http://corridoreis.anl.gov.*

Purpose of the RFI

The purpose of this RFI is to solicit information that will assist the Agencies in the development of the Section 368 Corridor Study and provide the foundation for the initial Regional Periodic Review. In particular, the Agencies seek responses to the questions posed in the sections below. All work described in the Work Plan and Memorandum of Understanding (MOU) is contingent upon the availability of appropriated funds.

Section 368 Corridor Study

On July 7, 2013, the Agencies finalized a Corridor Study Work Plan for the Section 368 Corridors (Work Plan). The Work Plan identifies how information will be gathered and analyzed and establishes a schedule for completion of the Section 368 Corridor Study. Under the Section 368 Corridor Study, the Agencies will study Section 368 Corridors to assess their overall usefulness with regard to various factors, including their effectiveness in reducing the proliferation of dispersed rights-of-way across Federal lands. The Agencies will also assess the efficiency and effectiveness of the Section 368 Corridors and record lessons learned in the siting process. The Section 368 Corridor Study will also:

• Identify where corridors are being over- or underutilized and evaluate use of the IOPs;
• Focus on information relating to the use of Section 368 Corridors that is publicly available at the time the Agencies initiate the Section 368 Corridor Study;
• Help to inform the Regional Periodic Reviews and review of the IOPs; and
• Be made public upon completion.

(1) *Updates to Spatial Data.* A geographic information system (GIS) was used to support the mapping and location-specific analyses in the Final West-wide Energy Corridor Programmatic Environmental Impact Statement (EIS). GIS databases contain spatial data including imagery, map graphics, and associated tabular data, and GIS software allows for storing, processing, analyzing, modeling, and visualizing the spatial data. Lists of the GIS data that were used for the analyses and maps in the Programmatic EIS as well as the sources, quality, and scale of the data are posted at *http://corridoreis.anl.gov* (Appendix I of the Programmatic EIS and Appendix A of the Work Plan). Under the Section 368 Corridor Study, the Agencies will update the Programmatic EIS data using compatible, publicly available data. The Agencies are interested in suggestions of new or updated compatible, publicly available data that may be utilized to inform the Section 368 Corridor Study. Are there any new or updated data that is publicly available?

(2) *Types of Authorized Projects to Consider.* The Agencies propose to focus on 100 kilovolt (kV) or higher electric transmission lines and oil, gas, and hydrogen pipelines, 10 inches or more in diameter that have been authorized on Federal lands (both inside and outside of Section 368 Corridors) since approval of the DOI and FS RODs. The purposes of assessing the use of Section 368 Corridors is to evaluate their effectiveness in improving reliability, relieving congestion, and enhancing the capability of the national grid to deliver electricity across Federal lands and to evaluate IOPs for the Section 368 Corridor Study. Are there any other types of projects that the Agencies should consider to assess use of Section 368 Corridors?

(3) *Methods for Assessing Effectiveness of IOPs.* The Agencies will compile information relating to the use of IOPs for projects authorized since approval of the RODs, potentially by project type, based on consideration of projects identified in response to question 2 that are located entirely or partially within a Section 368 Corridor. Are there methods the Agencies should consider using to evaluate the effectiveness of the IOPs?

Regional Periodic Review

On July 7, 2013, the Agencies entered into an MOU describing the process for conducting Regional Periodic Reviews, including concurrent review of IOPs. The Agencies will identify and prioritize regions for periodic review.

(1) *New Relevant Information.* In accordance with the MOU, as a part of the Regional Periodic Reviews (including review of IOPs), the Agencies will consider new, relevant information. In general, the Agencies will consider significant regional energy development and corridor and transmission plans or studies, which are supplemented by project-specific studies that were completed after January 2009 or that are substantially underway. Examples of new information the Agencies will consider include the following:

• Results of: (1) Joint studies of electric transmission needs and renewable energy potential being conducted by the Western Electricity Coordinating Council and the Western Governors' Association (WGA) and funded by the DOE; and (2) The DOE's Transmission Corridor Assessment Report for Western States (DOE Corridor Study). These studies address the need for upgraded and new electrical transmission and distribution facilities to improve reliability, relieve congestion, and facilitate renewable energy development. The DOE Corridor Study is addressed in the June 7, 2013, Presidential Memorandum, "Transforming our Nation's Electric Grid Through Improved Siting, Permitting, and Review," available at *http://www.whitehouse.gov/the-press-office/2013/06/07/presidential-memorandum-transforming-our-nations-electric-grid-through-i.*
• Results of the BLM's Rapid Ecoregional Assessments that characterize ecological values across regional landscapes;
• Once completed, the results of the Section 368 Corridor Study and review of the IOPs;
• Results of other ongoing resource studies, such as the WGA wildlife corridor study, the BLM's and FS's National Sage-Grouse Habitat Conservation Strategy, and the State of Wyoming's sage grouse strategy;
• Other factors, such as States' renewable portfolio standards, that address potential energy demand, sources, and loads, with particular regard to renewable energy;
• The BLM's Approved Resource Management Plan Amendments/ROD for Solar Energy Development in Six Southwestern States based on the joint BLM and DOE 2012 Solar Energy Development Programmatic EIS that assessed the environmental, social, and economic impacts associated with solar energy development on BLM-managed lands in Arizona, California, Colorado, Nevada, New Mexico, and Utah. The ROD amends 89 BLM land use plans incorporating land use allocations and programmatic Solar Energy Zone-specific design features; updates and revises policies and procedures for solar energy development; and implements a comprehensive solar energy program for administering the development of utility-scale solar energy resources in 6 southwestern states;
• The BLM Arizona Restoration Design Energy Project Final EIS and ROD issued in January 2013;
• Information from the Desert Renewable Energy Conservation Plan Draft EIS/Environmental Impact Report scheduled for release in 2014;
• The BLM/FS Greater Sage-Grouse Sub-Regional Planning Areas that overlie Section 368 Corridors;
• Draft and Final EISs, land use plan amendments, and related studies for pipelines 10 inches or more in diameter and 100 kV or higher electric transmission lines that utilize Section 368 Corridors;
• The National Renewable Energy Laboratory's Renewable Energy Futures Study Report (2012); and
• New IOPs submitted by the Plaintiffs who are a party to the Settlement.

Is there any other publicly available information that the Agencies should consider as part of the initial Regional Periodic Review, including review of the IOPs, and if so, where or how can it be found, and what parts of it are relevant to this RFI?

(2) *Identification of New Requirements.* Are there any laws, regulations, or other requirements that have been implemented since issuance of the DOI and FS RODs in January 2009 that the Agencies should consider when reviewing Section 368 Corridors?

(3) *Identification of Regional Stakeholder Fora.* The Agencies have identified an initial list of existing regional stakeholder fora as possible options for stakeholder engagement during Regional Periodic Reviews (e.g., BLM and FS Resource Advisory Councils, the Western Electricity Coordinating Council, Landscape Conservation Cooperatives, Western Governors' Association, and the Indian Country Energy and Infrastructure Working Group, which was established to work collaboratively with the DOE).

Are there any additional regional stakeholder fora that the Agencies should consider for stakeholder engagement during Regional Periodic Reviews?

(4) *Changes to IOPs.* Are there any additions, deletions, or revisions the Agencies should consider making to the IOPs that were adopted in the DOI and FS RODs, and what is the rationale for those changes?

(5) *Comments on New IOPs.* The Agencies have committed to consideration of new IOPs submitted by the Plaintiffs who are parties to the Settlement. The new IOPs are available at *http://corridoreis.anl.gov* Are there any comments on these new IOPs?

Michael D. Nedd,

Assistant Director, Energy, Minerals, and Realty Management, Bureau of Land Management, U.S. Department of the Interior.

Tony L. Tooke,

Associate Deputy Chief, National Forest System, U.S. Forest Service, U.S. Department of Agriculture.

Matt Rosenbaum,

Acting Director National Electricity Delivery, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy.

[FR Doc. 2014–06945 Filed 3–27–14; 8:45 am]

BILLING CODE 4310–84–P

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

[S1D1S SS08011000 SX066A000 67F 134S180110; S2D2S SS08011000 SX066A00 33F 13xs501520]

Notice of Availability of the Four Corners Power Plant and Navajo Mine Energy Project Draft Environmental Impact Statement

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Notice of Availability.

SUMMARY: In accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, the Office of Surface Mining Reclamation and Enforcement (OSMRE) has prepared a Draft Environmental Impact Statement (EIS) for the Four Corners Power Plant and Navajo Mine Energy Project (Project), in northwestern New Mexico and by this notice is announcing the opening of the comment period.

DATES: To ensure comments will be considered, the OSMRE must receive written comments on the Draft EIS no later than May 27, 2014. The OSMRE will conduct public meetings in the following locations and on the following dates:

Hotevilla, AZ:—*Navajo and Hopi interpreters available*
  Wednesday, April 30, 5 to 8 p.m.
  Hotevilla Village (Hotevilla Youth and Elderly Center), Auditorium, 1 Main St., Hotevilla, AZ 86030

Cortez, CO:
  Thursday, May 1, 5 to 8 p.m.
  Montezuma-Cortez High School, The Commons Area, 206 W. Seventh St., Cortez, CO 81321

Burnham, NM:—*Navajo interpreters available*
  Friday, May 2, 5 to 8 p.m.
  Tiis Tsoh Sikaad (Burham) Chapter House, Large Meeting Room, 12 miles east of U.S. 491 on Navajo Route 5 and ½ mile south on Navajo Route 5080

Durango, CO:
  Saturday, May 3, 9:30 a.m. to 12:30 p.m.
  Durango Community Recreation Center, 2700 Main Ave., Durango, CO 81301

Farmington, NM:
  Monday, May 5, 5 to 8 p.m.
  Farmington Civic Center, Exhibition Hall, 200 W. Arrington St., Farmington, NM 87401

Shiprock, NM:—*Navajo interpreters available*
  Tuesday, May 6, 5 to 8 p.m.
  Shiprock High School, Commons, Highway 64 W, Shiprock, NM 87420

Nenahnezad, NM:—*Navajo interpreters available*
  Wednesday, May 7, 5 to 8 p.m.
  Nenahnezad Chapter House, Multipurpose Hall, County Road 6675, Navajo Route 365, Fruitland, NM 87416

Window Rock, AZ:—*Navajo interpreters available*
  Thursday, May 8, 5 to 8 p.m.
  Navajo Nation Museum, Resource Room, Highway 264, Postal Loop Road, Window Rock, AZ 86515

Albuquerque, NM:
  Friday, May 9, 5 to 8 p.m.
  Indian Pueblo Cultural Center, Silver and Turquoise Room, 2401 12th St. NW., Albuquerque, NM 87104

Public meetings will be conducted in an open-house style format. The meeting rooms will be arranged into the following areas: (1) An area where attendees may view a video discussing the project and the Draft EIS findings; (2) an area containing informational displays where attendees may read and subsequently discuss the project and the Draft EIS findings with OSMRE representatives, the Bureau of Indian Affairs (BIA) and consultant personnel; (3) an area where attendees may record and submit written comments; and (4) an area where an OSMRE representative and a transcriber will record oral comments. Hopi and Navajo interpreters will be present at meetings on the Hopi and Navajo Reservations. If you require reasonable accommodation to attend one of the meetings, please contact the person listed under **FOR FURTHER INFORMATION CONTACT** at least one week before the meeting.

ADDRESSES: The draft EIS is available for review at *http://www.wrcc.osmre.gov/Current_Initiatives/FCNAVPRJ/FCPPEIS.shtm.* Paper and computer compact disk (CD) copies of the Draft EIS are available for review at the OSMRE Western Region office, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733. In addition, a paper and CD copy of the Draft EIS is also available for review at each of the following locations:

Navajo Nation Library—Highway 264 Loop Road, Window Rock, AZ 86515
Navajo Nation Division of Natural Resources—Executive Office Building 1–2636, Window Rock Blvd., Window Rock, AZ 86515
Hopi Public Mobile Library—1 Main Street, Kykotsmovi, AZ 86039
Albuquerque Main Library—501 Copper Ave NW., Albuquerque, NM 87102
Cortez Public Library—202 N. Park Street, Cortez, CO 81321
Durango Public Library—1900 E. Third Ave, Durango, CO 81301
Farmington Public Library—2101 Farmington Ave, Farmington, NM 87401
Octavia Fellin Public Library—115 W. Hill Ave., Gallup, NM 87301
Shiprock Branch Library—U.S. Highway 491, Shiprock, NM 87420
Tuba City Public Library—78 Main Street, Tuba City, AZ 86045
Chinle Chapter House—Highway 191, Chinle, AZ 86503
Coalmine Canyon Chapter House—Highway 160 and Main Street, Tuba City, AZ 86045
Nenahnezad Chapter House—County Road 6675, Navajo Route 365, Fruitland, NM 87416
Shiprock Chapter House—East on Highway 64, Shiprock, NM 87420
Tiis Tsoh Sikaad Chapter House—12 miles east of U.S. 491 on Navajo Route 5 and ½ mile south on Navajo Route 5080
Upper Fruitland Chapter House—N562 Building #006–001, North of Highway N36, Fruitland, NM 87416
OSMRE Albuquerque Area Office—435 Montano Road, NE., Albuquerque, NM 87107
BIA Chinle Office—Navajo Route 7, Building 136–C, Chinle, AZ 86503

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THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV

May 27, 2014

Mr. Michael D. Nedd,
Assistant Director
Energy, Minerals, and Realty Management
Bureau of Land Management
U.S. Department of the Interior

Mr. Tony L. Tooke,
Associate Deputy Chief
National Forest System
U.S. Forest Service
U.S. Department of Agriculture

Mr. Matt Rosenbaum,
Acting Director
National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

Via: 368corridors@blm.gov

Re: Request for Information: West-wide Energy Corridor Review; FR Doc. 2014–06945

Dear Mr. Nedd, Mr. Tooke, and Mr. Rosenbaum:

The Arizona Game and Fish Department (Department) reviewed the *Request for Information: West-wide Energy Corridor Review,* published by the U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS) in the ***Federal Register*** on March 28, 2014. We offer the following comments.

The Department is supportive of the re-evaluation and revision process to ensure corridors better avoid environmentally sensitive areas and reduce proliferation of dispersed right-of-ways (ROWs). This work is also consistent with the June 7, 2013 *Presidential Memorandum: Transforming our Nation's Electric Grid Through Improved Siting, Permitting, and Review*, which calls on federal agencies to promote the development of energy right-of-way corridors with a special focus on developing renewable energy resources while minimizing impacts on environmental and cultural resources and developing interagency mitigation plans.

The Department understands that the BLM and USFS will be identifying one or more priority regions for the first WWEC re-evaluation effort. We recommend that western Arizona be included as a priority region since low potential resource conflicts lands have already been identified for solar and wind development in Arizona. The Arizona BLM office undertook a statewide assessment, the Restoration Design Energy Project (RDEP), that identified 196,000 acres of low-conflict BLM lands suitable for solar and wind development. This assessment also identified USFS, state trust, and private lands that met similar criteria. The Arizona State Land Department undertook a similar assessment of state trust lands that identified lands suitable for renewable energy development. Finally, Arizona counties and other local jurisdictions are identifying Renewable Energy Incentive Districts where future solar and wind development could occur. By identifying these places in advance, projects can be guided to lower-conflict places on the landscape, reducing possible resource conflicts.

The Department recommends using the Arizona BLM's approach in the Restoration Design Energy Project (RDEP) to better avoid environmentally sensitive areas, as detailed in the Settlement Agreement for BLM and USFS to improve their approach to completing environmental assessments of the WWEC. We believe WWEC, like RDEP, should extend this approach to non-federal lands, including private and state trust lands. The Arizona BLM used an approach to screening potential wind and solar development lands in RDEP that should be used as a model for screening the WWEC. RDEP did not identify or designate priority "Renewable Energy Development Areas" in locations that conflicted with the screens. Though the RDEP screens were developed in consideration of wind and solar development, most of the screens are also appropriate in consideration of large-scale transmission development (100 kV or greater). If WWEC conflict with the screens, the BLM should address the conflict by:

- removing or adjusting the WWEC to avoid the conflict;
- establishing Interagency Operating Procedures to address the conflict; and/or
- recommending off-site, compensatory mitigation to address the conflict.

The landscape-scale assessment used in RDEP is consistent with several BLM initiatives including the BLM's Western Solar Energy Program and BLM's Rapid Ecoregional Assessments. It is also consistent with BLM guidance directing a landscape-scale or regional approach to planning and mitigating for energy development in the agency's Draft Regional Mitigation Manual. The Department believes a more comprehensive approach to planning and mitigating for renewable energy and transmission development is needed to limit and off-set impacts while supporting responsible development.

The Department recommends using federal and state agency data to develop their screens. The Department has a few datasets that should be considered during the WWEC evaluation process. They include:

- **HabiMap Data** – Predictive models for species within our State Wildlife Action Plan. Website: http://www.habimap.org/ To request the data, contact Richard Lawrence, RLawrence@azgfd.gov.
- **Heritage Data** – Actual occurrences of special status species. Contact Sabra Tonn, STonn@azgfd.gov to discuss potential data release.

- **Arizona Wildlife Connectivity Assessment: Statewide Analysis** – Recently developed state-scale models of landscape integrity and connectivity. To request the data contact Julie Mikolajczyk, JMikolajczyk@azgfd.gov.
- **2007-2008 region-specific Linkage Design Reports** – Developed by the Department and Northern Arizona University. They are available at http://corridordesign.org/linkages/arizona.

We appreciate the opportunity to provide comments on the WWEC. The Department would like to continue to coordinate directly with BLM and USFS on this effort. If you have any questions regarding this letter, please contact me at (623) 236-7606.

Sincerely,

Ginger Ritter

Ginger Ritter
Project Evaluation Program Specialist, Habitat Branch

cc: Laura Canaca, Project Evaluation Supervisor, Habitat Branch
Dave Dorum, Habitat Program Manager, Region I
Steve Rosenstock, Habitat Program Manager, Region II
Trevor Buhr, Habitat Program Manager, Region III
Bill Knowles, Habitat Program Manager, Region IV
John Windes, Habitat Program Manager, Region V
Kelly Wolff-Krauter, Habitat Program Manager, Region VI

AGFD # M14-04044217

THE CHURCH OF
JESUS CHRIST
OF LATTER-DAY SAINTS

CHURCH HISTORY DEPARTMENT
Church History Library
15 East North Temple Street
Salt Lake City, Utah 84150-1600

May 19, 2014

Michael D. Nedd
Assistant Director
Energy, Minerals, and Realty Management
Bureau of Land Management
U.S. Department of the Interior

Tony L. Tooke
Associate Deputy Chief
National Forest System
U.S. Forest Service
U.S. Department of Agriculture

Matt Rosenbaum
Acting Director National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

Dear Sirs:

This letter is in response to the Request for Information (RFI) concerning Section 368 Corridors, published in the Federal Register, volume 79, number 60, on Friday, March 28, 2014. We are thankful for this opportunity to provide information in relation to (1) the preparation of regional periodic reviews of designated Section 368 Corridors, and (2) the development of a corridor study to assess the overall usefulness of the Section 368 Corridors.

Insofar as the Corridor Study will identify where Section 368 Corridors are being over-utilized, we wish to take this opportunity to alert you to a number of serious problems with the section of a corridor that is sited through the Pine Valley Ranger District of the Dixie National Forest in southeastern Utah.

First, the corridor section that passes through the Dixie National Forest imposes significant visual impacts to the Mountain Meadows Massacre Site National Historic Landmark, the Mountain Meadows Massacre National Historic Site, and sections of the Old Spanish National Historic Trail. These cultural resources are significant to our nation's history and deserve to be protected from physical intrusions stemming from energy development projects. When the current energy corridor was approved, only the National Historic Site and Trail had been established. However, additional considerations are now required because a portion of the area was designated a National Historic Landmark in 2011. According to the regulations of the

Advisory Council on Historic Preservation, an agency must "to the maximum extent possible... minimize harm" to National Historic Landmarks. It should also be noted that a proposed boundary change to the Mountain Meadows Massacre Site National Historic Landmark will be reviewed before the National Park System Advisory Board's Landmarks Committee on May 28-29, 2014, resulting in the possible expansion of this highly significant historic site.

Second, the section of the corridor within the Dixie National Forest is currently heavily congested with four transmission lines and three pipelines (two natural gas lines and one diesel fuel line) that pass through a two-mile wide area. The construction of additional energy projects would only further congest the area, increasing the significant risk of massive blackouts if a fire or other disaster were to occur within the corridor. Adding to the congestion problem is the existence of federally designated Inventoried Roadless Areas (IRAs) adjacent to the corridor. Between the National Historic Landmark on the west and the IRAs on the east, the corridor suffers from a formidable bottleneck in the Mountain Meadows. We, and others, believe there is simply no more room to safely build additional energy projects through this section of the corridor.

Third, the physical remains of the victims of the Mountain Meadows Massacre are located in unmarked graves throughout the Mountain Meadows. Although one of the mass graves, containing the bones of 29 of the 120 victims, was accidentally unearthed in 1999 during the construction of a monument at the site, several other similar graves are scattered throughout the valley. Unfortunately, although historical records document the existence of these burials, they do not indicate their exact location, making the entire valley a highly sensitive area. Any construction activities in this area run the risk of disturbing the graves of the massacre victims.

Last, the number of new renewable energy projects in Wyoming is ever increasing, helping supply the growing demands for such energy in the Desert Southwest. Given this reality, it is inevitable that additional energy development projects will be planned to pass through the existing corridor. However, each new project will face the same challenges outlined above. Indeed, these challenges proved considerable to negotiate for the Sigurd to Red Butte Transmission Project, the Final EIS and ROD for which was issued in late December 2012. In the end, a carefully negotiated compromise was agreed upon, which was colloquially referred to as the "snuggy route" because it sited the transmission line tightly between protected lands and existing utility lines. Similar challenges will be even greater with two new energy projects proposed to pass through the corridor – the TransWest Express (TWE) and Zephyr transmission line projects. In short, all future projects will face the same issues and challenges that Sigurd to Red Butte faced and that TWE and Zephyr are currently facing unless something is done about the existing corridor.

In light of these concerns, we support a revision of the existing corridor, or the creation of a new energy corridor, which will avoid the current challenges altogether. Two viable options were presented as alternate routes in the Draft Environmental Impact Statement for the TransWest Express (TWE) Transmission Project, published in June 2013. The Bureau of Land Management has selected one of these as the Agency Preferred Alternative for the TWE project. These routes, depicted in green and circled in orange on the enclosed map, would almost exclusively pass through unrestricted land owned by the Bureau of Land Management. A new or revised energy corridor along one of these routes would effectively avoid the complications related to the mitigation of negative impacts to historically significant resources with the Mountain Meadows, and could be designed large enough to accommodate the number of energy projects planned for the future.

We thank you again for this opportunity to respond to your Request for Information and hope that these serious problems with the Section 368 Corridor through the Dixie National Forest can be resolved in such a way to protect and preserve the historic and cultural resources in the area and ensure the success and safety of the existing utility lines.

Respectfully,

Richard E. Turley, Jr.
Assistant Church Historian and Recorder
The Church of Jesus Christ of Latter-day Saints
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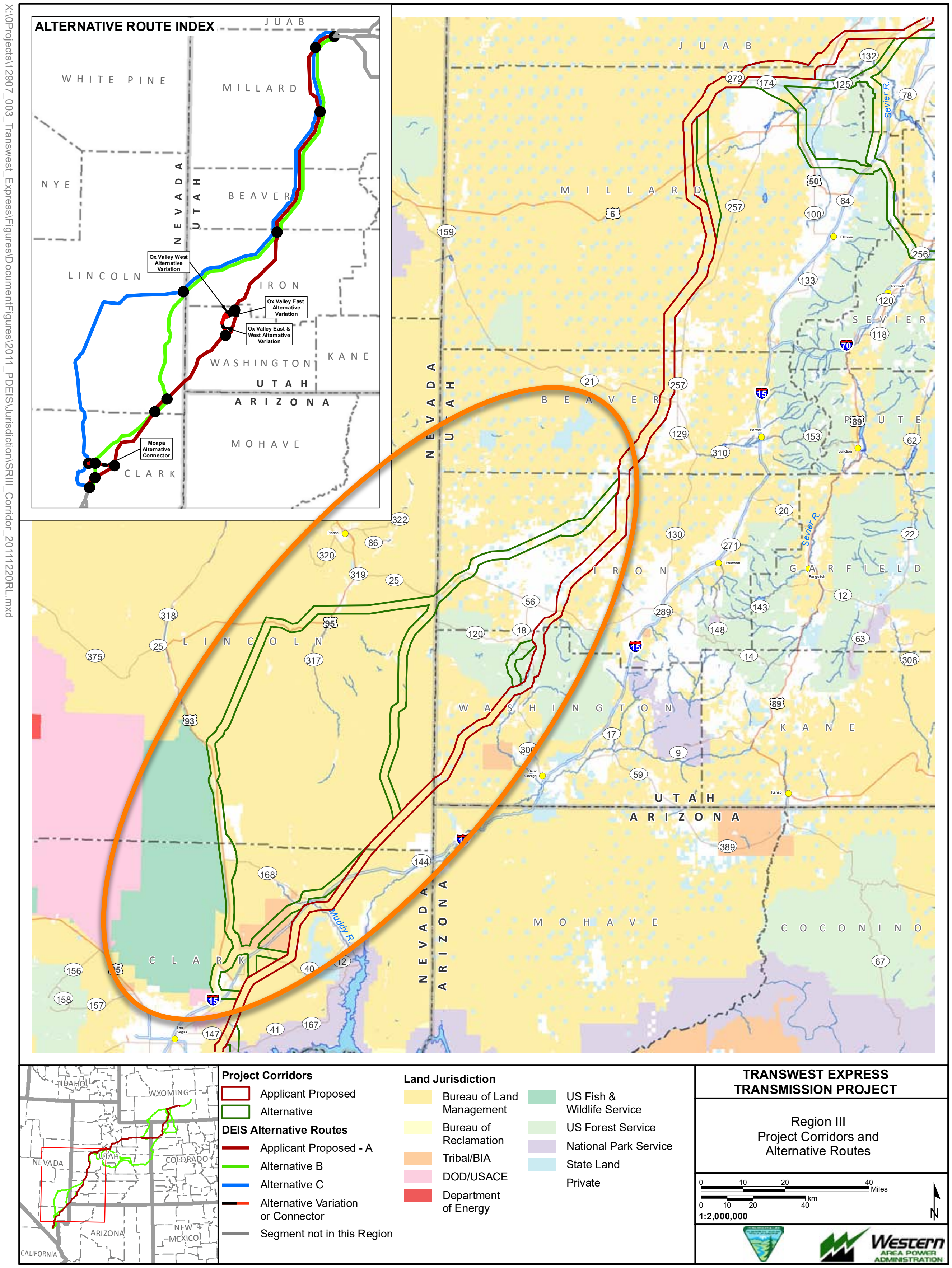

X:\0Projects\12907_003_Transwest_Express\Figures\DocumentFigures\2011_PDEIS\Jurisdiction\SRIII_Corridor_20111220RL.mxd
ALTERNATIVE ROUTE INDEX
Ox Valley West Alternative Variation
Ox Valley East Alternative Variation
Ox Valley East & West Alternative Variation
Moapa Alternative Connector
Project Corridors
Applicant Proposed
Alternative
DEIS Alternative Routes
Applicant Proposed - A
Alternative B
Alternative C
Alternative Variation or Connector
Segment not in this Region
Land Jurisdiction
Bureau of Land Management
Bureau of Reclamation
Tribal/BIA
DOD/USACE
Department of Energy
US Fish & Wildlife Service
US Forest Service
National Park Service
State Land
Private
TRANSWEST EXPRESS TRANSMISSION PROJECT
Region III
Project Corridors and Alternative Routes
1:2,000,000
Western AREA POWER ADMINISTRATION

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

March 28, 2014 Federal Reg Notice: Request for Information: West-Wide Energy Corridor Review

1 message

Burdick, Troy <troy.burdick@bia.gov> Mon, Mar 31, 2014 at 2:13 PM
To: 368corridors@blm.gov
Cc: sfusilie@blm.gov

In response to Section 386 Corridor Study (1) Updates to Spatial Data - Public data pertaining to tribal lands in California can be found at the link below (Reservation GIS files). This data is more accurate and up-to-date than the Census Bureau data.

http://www.bia.gov/WhoWeAre/RegionalOffices/Pacific/index.htm

Since the completion of the PEIS, one specific parcel indicated as BLM lands are now under the administrative jurisdiction of the BIA. Specifically, corridor 18-23 near Benton, California (Mono County). This analysis is based on current data provided at http://corridoreis.anl.gov. In feature classes:

sec368zone_070715_080905_changes - OBJECTID 1396
sec368zone_att - OBJECTID 2621
sec368zone - OBJECTID 365 (shown in attached map)

The OBJECTID's above all cross tribal land that was under the jurisdiction of BLM, but was subsequently transferred to the jurisdiction of the BIA. The parcel is located in Section 11, Township 2 South, Range 31 East MDM. The location can be verified upon reviewing the BIA data referenced above.

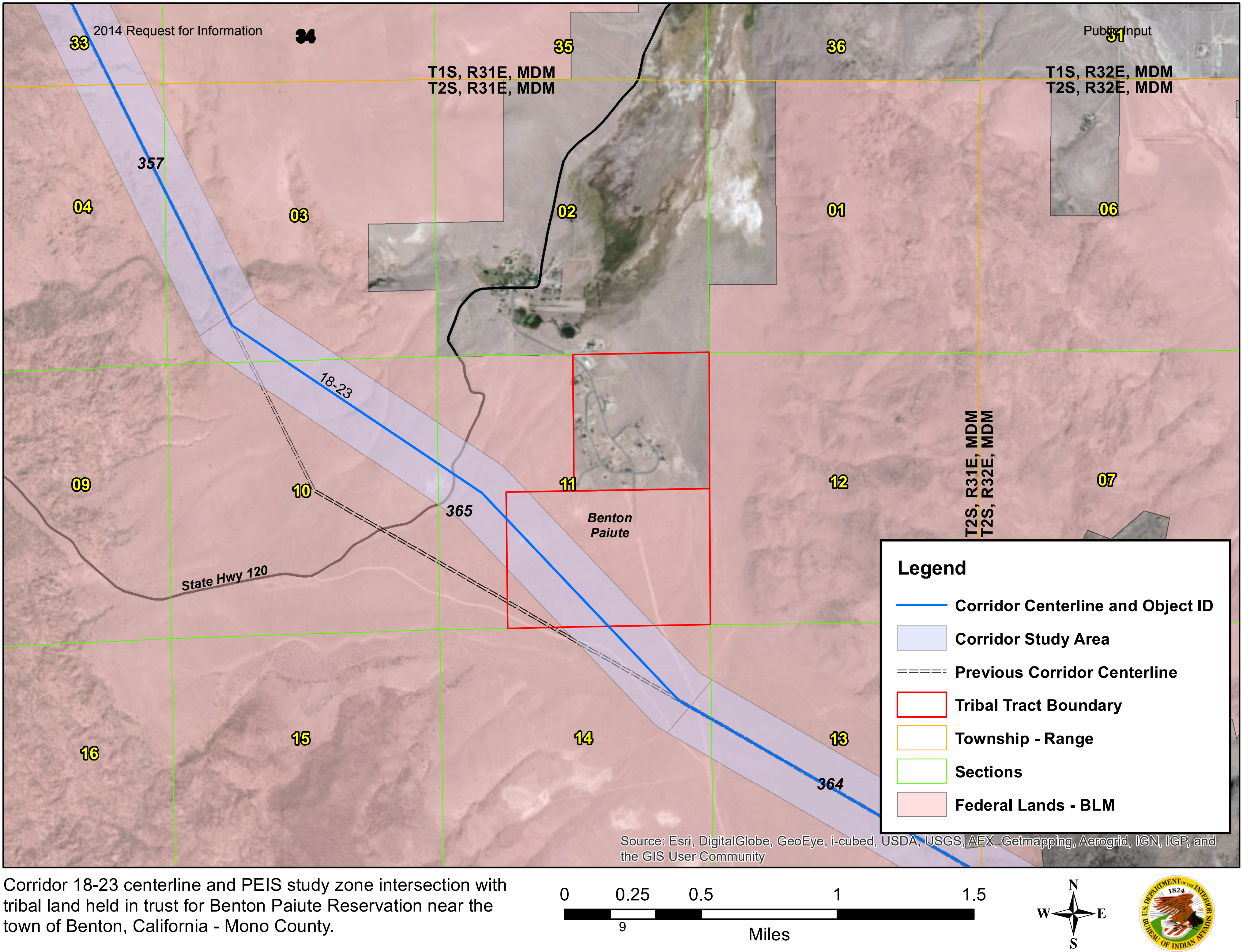
I have attached a map for reference.

--

Troy Burdick
Superintendent, Central California Agency
Bureau of Indian Affairs
U. S. Department of the Interior
650 Capitol Mall, Suite 8-500
Sacramento, CA 95814

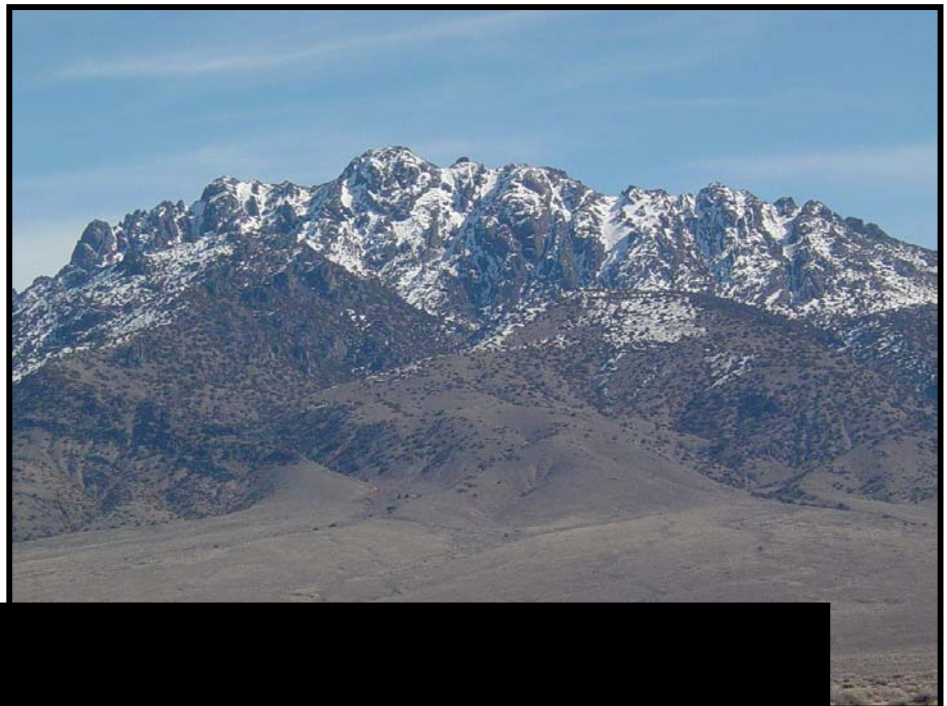
Voice: (916) 930-3774
Fax: (918) 930-3780

Corridor 18-23 Benton Paiute Reservation.pdf
4307K



Corridor 18-23 centerline and PEIS study zone intersection with tribal land held in trust for Benton Paiute Reservation near the town of Benton, California - Mono County.

The western escarpment of King Lear Peak in the South Jackson Mountains Wilderness Area



Record of Decision

Black Rock Desert High Rock Canyon Emigrant Trails National Conservation Area, Associated Wilderness and Other Contiguous Lands

Record of Decision

Autumn in the South Jackson Mountains looking towards King Lear Peak

INTRODUCTION

The Black Rock-High Rock planning area consists of 1.2 million acres of public lands in northwest Nevada (Map 1-1). This area includes parts of Washoe, Pershing and Humboldt counties and is administered by the Bureau of Land Management's Winnemucca (Winnemucca, Nevada) and Surprise (Cedarville, California) Field Offices. The planning area includes all 1,172,680 acres designated in the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area Act of 2000 as the NCA and ten Wilderness Areas. Several other relatively small areas not within the NCA or Wilderness Areas are included in the planning area because they are contiguous to the NCA or Wilderness and similar planning issues apply to them. These other areas (totaling 32,360 acres) are: the South Playa located between the south boundary of the NCA and the town of Gerlach, the Lahontan Cutthroat Trout Wilderness Study Area (WSA), acquired federal lands within the WSA, the strip of public land located between the WSA and the Summit Lake Paiute Indian Reservation, and road and motorized trail corridors associated with Wilderness access and boundaries and with the NCA boundary.

The primary decision is to approve the attached Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area and Associated Wilderness Areas, and Other Contiguous Lands in Nevada Resource Management Plan (RMP). Included in the RMP are some management actions that are implementation decisions rather than land use planning decisions. These implementation decisions are discussed in Attachment 1.

LAND USE PLAN DECISIONS

The decision is hereby made to approve the attached Resource Management Plan for the Black Rock Desert-High Rock Canyon Emigrant Trails NCA and Associated Wilderness Areas, and Other Contiguous Lands in Nevada within the Surprise and Winnemucca Field Offices, Bureau of Land Management (BLM). This plan was prepared under the regulations implementing the Federal Land Policy and Management Act of 1976 (43 CFR Part 1600). An environmental impact statement was prepared for this RMP in compliance with the National Environmental Policy Act (NEPA) of 1969. The RMP is essentially identical in intent to the preferred Alternative D described in the Proposed Resource Management Plan and Final Environmental Impact Statement for the planning area published in September 2003. Specific management goals, objectives and decisions for public lands within the planning area are presented in the section entitled "Resource Management Plan" later in this document.

Land use plan decisions are identified in the attached RMP (summarized in Table ROD-1) and include:

1) Goals, objectives, standards, and guidelines that define desired outcomes or future conditions.

2) Land use allocations including:
Mineral withdrawals for locatable minerals
Two Areas of Critical Environmental Concern

3) Visual resource management (VRM) class designations

4) Allowable uses and restrictions including:
Specific off-highway vehicle (OHV) area designations
Mineral leasing restrictions
Areas allotted to and excluded from livestock grazing
Areas open or closed to specific types and levels of special recreation and land use permitting

This Record of Decision becomes effective on the date it is signed and finalizes the land use planning decisions described above. Administrative remedies for the land use plan goals, objectives and decisions are no longer available.

NOTICE OF MODIFICATION

The following modifications to the Proposed Plan are a result of comments and protests BLM received on the Proposed Plan and as a result of recommendations made during the Governor's consistency review. Final decisions, terms and conditions are described in detail in Chapter 2 of this Approved Plan.

Geothermal Leasing: The Proposed Plan stated that future geothermal leasing in the South Playa area could occur subject to no-surface-occupancy requirements. This decision has been modified to allow for future geothermal leasing in the South Playa area consistent with existing laws, regulations and other constraints imposed by the RMP.

OHV Areas: The Proposed Plan classified two small dry lakebeds as Open to OHV use. This decision has been changed so that OHV use on the two lakebeds will be limited to designated roads and trails.

Wildlife Management in Wilderness Areas: The Proposed Plan included specific decisions related to management of wildlife resources within designated wilderness areas by the Nevada Department of Wildlife (NDOW). Subsequent to publication of the FEIS/Proposed RMP, BLM and NDOW developed a Memorandum of Understanding (Supplement No. 9) on Wildlife Management in Nevada BLM Wilderness Areas. This memorandum included more comprehensive guidance on the subject than was contained in the Proposed Plan and also implemented interagency processes to accomplish wildlife management actions and resolve potential conflicts related to wildlife management in designated wilderness areas. The specific decisions within the Proposed Plan have been replaced with reference to the actions and processes contained within the MOU.

Table ROD-1.—*Summary of land use allocations*

	Number	Acres	Miles	Decision Reference\Map Number
Land Health Standards				
Area where Northwestern NV/Sierra Front Standards Apply		1,018,751		LHS-1\Map 2-1
Area where Northeastern CA/ Northwestern NV Standards Apply		186,289		LHS-1\Map 2-1
Transportation				
Routes designated as BLM System Roads	7		45	TRAN-1\Maps 2-2a – 2-2f
Routes designated for Wilderness Boundary and Other Access			343	TRAN-7\Maps 2-2g
Off-Highway Vehicle Management				
Area open to OHV use		104,775		OHV-1\Map 2-2a
Area closed to OHV use		751,893		OHV-1\Map 2-2a
Area with limited OHV use		348,371		OHV-1\Map 2-2a
Cultural Resource Management				
Class C emigrant trail segments closed to motorized vehicles	2		6	CRM-3\Map 2-2a, 2-2b, 2-2d, 2-2e
Paleontological Resource Management				
Area closed to fossil collection	1	252		PAL-3\Map 2-14a, 2-14b
Area open to fossil collection with restrictions		1,204,788		PAL-4
Wilderness Management				
Area adjacent to WSA managed to retain wilderness characteristics		1,092		LCT Area-1\Map 2-3
Special Management Areas				
Expand existing ACEC	1	2,077		ACEC-4\Map 2-4
Decrease existing ACEC	1	5,664		ACEC-3\Map 2-4
Recommend suitable WSR	0	0		WSR-1
Livestock Grazing Management				
Areas allotted to grazing	19	895,920[1]		GRAZ-1\Map 2-5
Areas unalloted to grazing	2	309,120		GRAZ-3\Map 2-5
Area excluded from grazing	1	2,562		GRAZ-3\Map 2-3
Areas with prescriptive grazing requirements	4	63,501[2]		GRAZ-3, GRAZ-10, GRAZ-11
Wild Horse and Burro Management				
Herd management areas	12	481,903[1]		WHB-1\Map 2-6
Unoccupied herd areas	1	3,669[1]		WHB-2\Map 2-6
Initial AMLs (minimum and maximums)				Table 2-5
Horses	1,079 to 1,586			
Burros	30 to 40			

	Number	Acres	Miles	Decision Reference\Map Number
Fire Management				
Area of full wildfire suppression		42,841		FIRE-2\Map 2-7
Area of potential for modified wildfire suppression		1,162,199		FIRE-2\Map 2-7
Visual Resource Management				
Area in VRM class I		767,475		VRM-1\Map 2-8
Area in VRM class II		437,565		VRM-2\Map 2-8
Lands and Realty				
Area within designated utility corridors	2	4,995		LAND-3, LAND-4\Map 2-10
Area where Recreation and Public Purposes Act leases would be issued		0		LAND-7
Area where above ground utilities not permitted		104,546		LAND-8
Energy and Mineral Management				
Areas open to mineral location		0		MIN-1
Areas open to mineral leasing (except geothermal)		0		MIN-2, MIN-3
Areas open to geothermal leasing		14,519		MIN-3\Map 2-12
Areas open to salable mineral disposal		0		MIN-5
Areas open to salable mineral use for maintenance of official roads		437,447		MIN-5
Visitor Use Management Zones				
Area designated as Front Country Zone		121,245		ZONES-1\Map 2-13
Area designated as Rustic Zone		316,076		ZONES-1\Map 2-13
Area designated As Wilderness Zone		767,719		ZONES-1\Map 2-13
Recreation				
Special Recreation Management Areas	1	1,205,040		REC-1
Areas where dispersed camping would be allowed		1,185,413		REC-5
Areas where vehicle related camping would restricted to designated sites		36,867		REC-6, REC-8\Map 2-14a, 2-14b
Designation of Desert Trail corridor			93	REC-16\Map 2-14a, 2-14b
Area of playa where campfires would be allowed only with protective pans and shields		104,546		REC-18\Map 2-14a
Area where collection of rock, minerals and non-vertebrate fossils allowed		1,204,788		REC-20
Areas where Class I Special Recreation Permits (SRP) would be issued		1,205,040		REC-23
Areas where Class II Special Recreation Permits (SRP) would be issued		1,205,040		REC-23
Areas where Class III Special Recreation Permits (SRP) would be issued		78,676	148	REC-23\Map 2-15
Areas where Class IV Special Recreation Permits (SRP) would be issued		78,676		REC-23\Map 2-15
Rocket launch safety zone		12,499		REC-28\Map 2-15

Notes

[1] Acres within the Planning Area.

[2] Acres included within areas allocated to livestock grazing, acres are estimate based upon current fences and topographic boundaries that may change during implementation.

Livestock Grazing and Vegetation Management: The Proposed Plan included a number of objectives related to livestock grazing and vegetation management. A number of these objectives have been reworded to better reflect the BLM's intent in managing these resources and to eliminate potential confusion among some members of the livestock industry.

Formatting of the RMP: The RMP has been reformatted and many decisions reworded from the way they appeared in the Proposed RMP. This was done to improve the readability and clarity of the document without changing the intent. In several cases, decisions that are considered implementation decisions were placed into separate implementation sections to distinguish them from land use plan decisions.

ALTERNATIVES CONSIDERED

Five alternatives are analyzed in detail in the Proposed RMP/FEIS (USDI-BLM 2003). Public input received throughout the planning process drove development of the alternatives. The overall theme determined the types of management actions that would be applied. All alternatives were designed to meet RMP management goals, but differed in how fast management goals would be met (when during the 20-year life of the plan management goals would be met), prioritization within programs, and emphases placed on different levels of visitor use and desired services.

All alternatives included maintenance of existing facilities; however, the level of maintenance varied by alternative. All alternatives incorporated or complied with the management direction provided by the existing biological opinions issued by the U.S. Fish and Wildlife Service (FWS), the applicable recovery plans developed by FWS, applicable Rangeland Health Standards, and the "Interim Management Policy for Lands Under Wilderness Review" (Wilderness IMP) (USDI-BLM 1995b).

No Action Alternative
The No Action Alternative continues present management based upon four existing management framework plans: Tuledad/Home Camp Management Framework Plan (MFP) (1976), Sonoma/Gerlach MFP (1982), Paradise/Denio MFP (1982), and Cowhead/Massacre MFP (1983) and various existing activity plans. It includes the management direction and protections provided by all currently approved activity plans such as allotment management plans or habitat management plans. Resource values or sensitive habitats receive management emphasis at present levels (maintaining existing conditions).

Alternative A (Emphasis on Natural Processes)
Management activities emphasize providing visitors the opportunity to experience, in a self-directed fashion, the physical setting that the emigrants and other early visitors to the area experienced in the mid-1800s. There would be limitations on visitor activities to protect both visitors and resources by minimizing the number of facilities provided, and creating additional restrictions on recreational activities. Existing transportation routes, signage, and visitor facilities would be rarely upgraded and then only to protect resource conditions. Leases for minerals would not be issued and issuance of rights-of-way grants would be restrictive.

Alternative A is considered the environmentally preferable alternative. This alternative would result in the fewest long-term changes associated with visitor services and would be expected to result in the slowest growth of visitation to the planning area.

Alternative B (Emphasis on Response to Change)
Alternative B was designated by BLM as the "Preferred" Alternative in the Draft EIS. This alternative also emphasizes providing visitors the opportunity to experience a physical setting close to what existed

in the mid-1800s, in a self-directed fashion. However, unlike Alternative A, this alternative employs a management approach that allows identification and accommodation to changing conditions over time by applying management decisions responsive to change. This alternative has the flexibility to respond to increasing visitation and resource deterioration that could occur over the long term.

Existing transportation routes, signage, and facilities could be changed in response to resource conditions or visitor use including the future development of a visitor center outside the NCA. Utility rights-of-way and land use permits would be subject to limitations consistent with VRM goals. Development of locatable, leasable and saleable minerals on federal lands within the planning area would be restricted.

Alternative C (Emphasis on Visitation and Interpretation)

Emphasis focuses on more active visitor support with less emphasis on management of natural and cultural resources. More recreational facilities, including trails and campsites, would be established than in other alternatives and there would be only minimal restrictions applied to recreational use. A range of upgrades would be anticipated to both the transportation system (new signage, etc.) and to facilities including a visitor center that could be developed in or near the NCA. The highest levels of utility rights-of-way as well as limited geothermal development and land use permits would be accommodated.

Alternative D (Proposed RMP)

Alternative D was not contained in the Draft EIS and RMP. It was developed as a result of public and agency comments received on the alternatives evaluated in the DEIS and represented the Proposed Resource Management Plan for the planning area. Alternative D draws primarily upon Alternative B, the preferred alternative in the Draft EIS, but selectively adopts portions of the other three alternatives. It corresponds closely with the recommendations made by the RAC subgroup and in other public comments in a manner that protects the resources and uses recognized in the NCA Act while minimizing short-term, on-the-ground changes in management. The use of an adaptive management approach provides flexibility to change management intensity as public use increases.

Tracks on the Playa

Views of Stevens Camp

MANAGEMENT CONSIDERATIONS FOR SELECTION OF THE RMP

The alternatives described in the Draft Management Plan/DEIS and public comment and input provided throughout this planning process were considered in preparing the Proposed Plan. The Proposed Plan was composed of a combination of decisions from the five alternatives considered in the Draft Management Plan/DEIS with emphasis on the Preferred Alternative (Alternative B).

This approach to managing the planning area was chosen because it: (a) is consistent with the requirements and intent of the NCA Act to "preserve, protect, and enhance" the nationally significant resources of the Black Rock Desert-High Rock Canyon area for "current and future generations of Americans", (b) best addresses the diverse community and stakeholder concerns in a fair and equitable manner, (c) is consistent with public input provided by the RAC Subgroup and Tribal, State and local governments, and (d) provides a workable framework for future management of the planning area. Among the attributes leading to this determination are: provisions for protecting NCA and wilderness resources (historic emigrant trails, archaeological, geological and biological resources, and wilderness characteristics) including special features such as special status species and riparian areas; establishment of an adaptive management program that will be used to define and protect resources as knowledge increases and circumstances change; and provisions for visitor use in a manner consistent with the protection of the cultural and natural resources. The Approved Plan is very similar to the Proposed Plan with minor revisions and clarifications stemming from the eight protests received and from the Governor's consistency review.

CONSISTENCY REVIEW

The Plan is consistent with plans and policies of the Department of the Interior and Bureau of Land Management, other federal agencies, Tribal governments, State government, and local governments to the extent that the guidance and local plans are also consistent with the purposes, policies, and programs of federal law and regulation applicable to public lands. No formal comments were received from federal or Tribal governments indicating the proposed plan was inconsistent with other existing plans or policies. The Governor of the State of Nevada in his letter dated November 17, 2003, identified potential inconsistencies with the proposed RMP from two state agencies. No inconsistencies were identified by any of the eight other state agencies that were involved in the planning process. BLM's analysis of the potential consistency issues from the Department of Wildlife and the Division of State Parks did not support the positions of the two state agencies. A letter documenting this analysis was provided to the Governor on December 10, 2003.

MITIGATION MEASURES

Mitigation measures are built into the RMP. Sensitive resources are protected through resource allocations, route and cross-country vehicle closures, and limitations and restrictions placed on developments and other activities. All practicable means to avoid or minimize environmental harm are carried forth in the RMP. During the next tier of planning, which allows for more detailed and site-specific analysis, additional measures will be taken, as necessary, in order to mitigate potential impacts to the environment. Monitoring will determine how effective these measures are in minimizing environmental impacts. Additional measures to protect the environment may be taken during or following monitoring.

PLAN MONITORING

During the life of the approved plan, the BLM expects that new information gathered from field inventories and assessments, research, other agency studies, and other sources will update baseline data or support new management techniques and scientific principles. To the extent that such new information or actions address issues covered in the RMP, the BLM will integrate the data through a process called plan maintenance or updating. This process includes the use of an adaptive management strategy. As part of this process, the BLM will review management actions and the RMP periodically to determine whether the objectives set forth in this and other applicable planning documents are being met. Where they are not being met, the BLM will consider adjustments of appropriate scope. Where the BLM considers taking or approving actions which would alter or not conform to the overall direction of the RMP, the BLM will prepare a plan amendment and environmental analysis of appropriate scope and seek additional public comment. A more detailed discussion of implementation and the use of adaptive management is included in Chapter 3 of the RMP.

PUBLIC INVOLVEMENT IN THE PLANNING PROCESS

SCOPING

Public involvement is an integral part of BLM's resource management planning process. The official start of the preparation of the Black Rock-High Rock NCA RMP/EIS began with publication of a Notice of Intent (NOI) to prepare a RMP/EIS in the *Federal Register* on December 6, 2001 (FR, Vol. 66, No. 235, pg. 63406). During the 90-day scoping period, this notice included an invitation to the public to suggest issues to be addressed in the RMP and to provide comments concerning management of the public lands and resources.

Public Meeting on the Draft RMP/EIS

Eight public meetings took place using an "open house" format between November 2001 and January 2002 to provide members of the public an opportunity to interact one-on-one with resource specialists from the BLM on various resources. Scoping workshops were held in Reno, Gerlach and Winnemucca, Nevada and Cedarville and Sacramento, California. In addition, a separate scoping workshop was held specifically for tribal representatives on December 4, 2001 in Reno, Nevada. Since publication of the NOI in the *Federal Register* did not occur until December 6, 2001, the initial five public workshops were precluded from being formal scoping meetings under the NEPA process. Two additional workshops using the identical format were conducted during the official scoping period in mid- January in Reno, Nevada and Sacramento, California. BLM considered all input received during all eight workshops as scoping comments. The 825 comments received during scoping were evaluated and incorporated as applicable during the development of alternatives and the impact analysis for the DEIS.

RESOURCE ADVISORY COUNCIL BLACK ROCK-HIGH ROCK SUBGROUP

The Sierra Front-Northwestern Great Basin and Northeast California Resource Advisory Councils (RACs) formed the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area Subgroup (NCA Subgroup) in April 2001. The purpose of the NCA Subgroup was to work collaboratively with BLM and to provide advice and counsel to the two parent RACs during the congressionally mandated, time-sensitive resource management planning process for the NCA Planning Area.

The NCA Subgroup included 26 members and met 10 times. In addition, some members also participated in field trips to the NCA, attended additional meetings of the two parent RACs, and took part in other NCA related BLM planning and public scoping meetings. The regular meetings and the workshop covered a total of 15½ days. Based on average attendance, this means that the members of the NCA Subgroup donated a total of 2,500 hours of their time to the NCA planning process.

DRAFT RMP/EIS

A 90-day comment period on the DEIS was initiated with the publication of the Notice of Availability in the *Federal Register* on March 7, 2003 (FR, Vol. 68, No. 45, pg. 11127). Approximately 1,300 copies of the Draft RMP/EIS (USDI-BLM 2003) were mailed out to interested agencies, Tribes, individuals, and organizations. The document was also posted on the Black Rock-High Rock NCA planning webpage (http://www.blackrockhighrock.com). Five public meetings were held during the 90-day public comment period on the Draft. A total of 320 comment letters were received from federal and State agencies, Tribal governments, local governments, advisory groups, conservation or environmental organizations, commercial interests, and other interested members of the public. Approximately 4,000 additional comments were received via email, most as form letters. About 75 letters contained what were considered substantive comments. Substantive comments and the BLM responses as well as the names of all those that commented were included in Appendix N of the “Proposed RMP/Final EIS” (USDI-BLM 2003).

PROPOSED RMP/FINAL EIS

A 30-day protest period on the Proposed RMP was initiated with the publication of the Notice of Availability in the Federal Register on September 17, 2003 (FR, Vol. 68, No. 180, pg. 54487) in accordance with 43 CFR Part 1610.5-2. Eight protests were received and subsequently resolved as described above in **Notice of Modification.** Additional comments were also considered during the preparation of the RMP to improve readability of the document.

CONSULTATION WITH U.S. FISH AND WILDLIFE SERVICE

Early in the planning process, the BLM initiated consultation with the U.S. Fish and Wildlife Service (USFWS) regarding the potential impacts of actions proposed in the Black Rock-High Rock NCA RMP to federally listed species or species proposed for listing. This was consistent with the procedures included in the memorandum of agreement between the BLM and the USFWS completed in September 2000. The USFWS provided BLM with lists of federally-listed species, species that are candidates for listing and other species of concern that may occur in the planning area. Species that are known to occur in the planning area were addressed in the planning process. Formal consultation with the Reno office of the USFWS concerning the potential impacts of implementing the RMP on four species was initiated on November 4th, 2003. The USFWS provided its Biological Opinion on the Proposed Plan on January 31, 2004. The Biological Opinion concluded that implementation of the RMP would not jeopardize the continued existence of any of the four affected species.

TRIBAL PARTICIPATION

Under Federal law and regulations, consultation with Native American Tribes having interests in the planning area is required. The NCA planning staff met or spoke with representatives of the governments of all such Tribes. Copies of the scoping packet, "Summary of the Analysis of the Management Situation" (USDI-BLM 2000f), "Draft RMP/EIS" (USDI-BLM 2001a), and "Proposed RMP/Final EIS" (USDI-BLM 2003) were sent to each Tribal government for review and comment. The Council Chairs of two Tribal governments were members of the RAC Subgroup and provided input to the BLM and other members of the subgroup throughout the planning process. A scoping workshop dedicated to Tribal representatives was held in Reno, Nevada in December 2001. The BLM held two open meetings specifically for Tribal representatives: on January 16, 2002 in Reno, Nevada, and on April 12, 2002 in Winnemucca, Nevada. BLM managers appeared before six Tribal Council meetings in northwest Nevada and northeast California in July and August 2003.

RMP IMPLEMENTATION

The Black Rock-High Rock NCA will develop an implementation strategy or "business plan", that will allow further opportunities for public involvement in determining what portions of the NCA RMP should be highest priority for future implementation.

BLM is proposing that the two RACs support the use of an implementation related RAC Subgroup to work collaboratively with BLM and to provide advice to the RACs during implementation of the RMP. The subgroup concept is discussed in Section 3.6 of the RMP.

Local Native American Tribes, the Nevada State Historic Preservation Office and the U.S. Fish and Wildlife Service will continue to be consulted during plan implementation for all actions that may affect, respectively, interests of Native Americans, cultural resources, or special status species. Cultural resource surveys and sensitive species surveys would be conducted prior to any ground-disturbing activity or land disposal. The results of these surveys would be used by BLM to determine whether additional consultations with the Nevada State Historic Preservation Office or the U.S. Fish and Wildlife Service would be required to comply with the National Historic Preservation Act or the Endangered Species Act respectively.

APPROVAL

We recommend approval of the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area and Associated Wilderness Areas, and Other Contiguous Lands in Nevada Resource Management Plan.

Dave Cooper
Black Rock-High Rock
NCA Manager

Owen Billingsley
Surprise Field Manager

Terry Reed
Winnemucca Field Manager

In consideration of the foregoing, we approve the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area and Associated Wilderness Areas, and Other Contiguous Lands in Nevada Resource Management Plan.

Robert Abbey
State Director
Nevada

Mike Pool
State Director
California

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Attachment 1

IMPLEMENTATION DECISIONS

It is BLM's intent to implement, over time, a number of specific project level actions authorized in the approved RMP, as funding and staff are available. These are called "implementation decisions" (as opposed to the land use planning decisions described above).

Implementation of many decisions in the RMP will require the preparation of detailed, project-level NEPA analyses prior to implementation. Public involvement opportunities, including appeal or protest opportunities, may be provided at that time.

The decisions referenced in Table ROD-2 have been considered in adequate detail in the DEIS and FEIS and therefore no additional detailed, project-level NEPA analysis is necessary to implement them. These decisions are now subject to appeal as described below.

Table ROD-2.—*Implementation Actions Now Subject to Appeal*

Action	Decision Reference
Transportation	
Designation of roads and motorized trails open to motorized use, except for motorized trails associated with TRAN-7.	OHV-2, LCT Area-3
Designation of routes closed to motorized use	OHV-2
Wilderness and Wildlife Management	
Maintenance of existing water sources for wildlife	FW-8

APPEAL PROCEDURES FOR IMPLEMENTATION DECISIONS

Any party adversely affected by implementation decisions contained in Table R-2 may appeal within 30 days of receipt of this decision in accordance with the provisions of 43 CFR 4.4. The appeal must include a statement of reasons or file a separate statement of reasons within 30 days of filing the appeal. The appeal must state if a stay of the decision is being requested in accordance with 43 CFR 4.21 and must be filed with the NCA Manager, at the following address:

Black Rock-High Rock NCA
Bureau of Land Management
5100 E Winnemucca Blvd
Winnemucca NV 89445-2921

A copy of the appeal, statement of reasons and all other supporting documents should be sent to the Regional Solicitor, Intermountain Region, US Department of the Interior, 6201 Federal Bldg, 125 South State Street, Salt Lake City UT 84138-1180. If the statement of reasons is filed separately it must be sent to the Interior Board of Land Appeals, Office of Hearings and Appeals, 4015 Wilson Blvd, Arlington VA 22203. It is suggested that any appeal be sent certified mail, return receipt requested.

Request for Stay

Should you wish to file a motion for stay pending the outcome of an appeal of these implementation decisions, you must show sufficient justification based on the following standards contained in 43 CFR 4.21:
The relative harm to the parties if the stay is granted or denied;
The likelihood of the appellant's success on the merits;
The likelihood of immediate and irreparable harm if the stay is not granted; and
Whether the public interest favors granting the stay.

As noted above, the motion for stay must be filed in the office of the authorized officer.

desert conservation
PROGRAM

May 22, 2014

Bureau of Land Management
368corridors@blm.gov

RE: Request for Information; West-Wide Energy Corridor Review

To whom it may concern:

Thank you for the opportunity to provide comments on the West-Wide Energy Corridor Review (Section 368 Corridors).

Clark County, Nevada, through the Desert Conservation Program (DCP), administers the Clark County Multiple Species Habitat Conservation Plan (MSHCP) and Section 10(a)(1)(B) incidental take permit (TE034927-0) for compliance with the Federal Endangered Species Act on behalf of the County and the cities of Boulder City, Henderson, Las Vegas, Mesquite and North Las Vegas; and the Nevada Department of Transportation (Permittees). The current permit covers 78 species, including the threatened desert tortoise.

Clark County is also a Cooperating Agency on the Bureau of Land Management's (BLM) amendment to the Las Vegas Resource Management Plan (RMP). This amendment is currently under review and revision.

After reviewing both the RMP and the West-Wide Energy Corridor Review (Section 368 Corridors) the Desert Conservation Program has several concerns:

It appears that there could be a lack of communication and coordination between the BLM Section 368 staff and the Las Vegas RMP staff on proposed utility corridors within Clark County.

Clark County recommends a complete review and analysis of the proposed Section 368 utility corridors to align or fit within existing Las Vegas RMP utility corridors. Clark County feels that proliferation of new utility corridors throughout northeastern and southwestern Clark County would further fragment and disturb prime desert tortoise habitat areas.

respect, protect and enjoy our desert!

333 North Rancho, Suite 625, Las Vegas, NV 89106 • Phone (702) 455-5942 • Fax (702) 382-4593

Bureau of Land Management
May 22, 2014
Page 2

Clark County further recommends that BLM Section 368 staff and BLM Las Vegas RMP staff collaborate and remove any proposed Section 368 utility corridors from within the Valley of Fire State Park and proposed Areas of Environmental Concern (ACECs) areas defined in the Las Vegas RMP.

If you have any questions or comments, please contact me with Clark County's Desert Conservation Program by telephone at (702) 455-3554 or via email to bice@clarkcountynv.gov.

Sincerely,

Lee Bice
Senior GIS Analyst

LB/aem

cc: Marci Henson, Program Manager Desert Conservation Program

respect, protect and enjoy our desert!
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May 27, 2014

Michael D. Nedd,
Assistant Director
Energy, Minerals, and Realty Management
Bureau of Land Management
U.S. Department of the Interior

Tony L. Tooke,
Associate Deputy Chief
National Forest System
U.S. Forest Service
U.S. Department of Agriculture

Matt Rosenbaum,
Acting Director
National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

Via: 368corridors@blm.gov

Re: Recommendations Related to the Request for Information: West-wide Energy Corridors Review

Dear Mr. Nedd, Mr. Tooke, and Mr. Rosenbaum:

Thank you for the opportunity to submit comments in response to the Request for Information: West-Wide Energy Corridor (WWEC) Corridor Study and Regional Periodic Review. Defenders of Wildlife (Defenders) believes that federal policy should promote the development of renewable energy without sacrificing irreplaceable wildlife resources. Defenders works to secure the adoption, by the administration, the Congress, and the renewable energy industry, of policies and programs that will facilitate the production and use of renewable energy resources while protecting wildlife and ecosystems.

Renewable energy is being developed at an unprecedented scale. For example, cumulative installed wind capacity at the end of 2005 was 9,147 MW and by the end of 2013 was 61,108 MW—a 668% increase over eight years.[1] In some cases, new transmission lines will be needed to carry remote renewable energy resources to population centers. Not all lands are appropriate for energy infrastructure, however, and the full range of environmental impacts from both transmission and generation need to be carefully considered when planning for an electric grid with increasing reliance on renewable sources.

Our comments are intended to ensure that the agencies structure the Corridor Review and Regional Periodic Review processes to adequately incorporate environmental and wildlife concerns, in particular with regards to several imperiled species, as well as species of economic and recreational importance. In order to protect our Nation's wildlife, water, and wildlife habitat it is important that planning for utility corridor development at a west-wide scale be consistent with the best available science and with existing federal and state conservation priorities. The processes should provide the public with an opportunity to understand in detail how wildlife science

[1] American Wind Energy Association, Wind Energy Facts at a Glance. Available at: http://www.awea.org/Resources/Content.aspx?ItemNumber=5059 [accessed 4/20/2014].

and conservation priorities were developed and applied in the forthcoming WWEC review documentation, and to evaluate these independently and/or in tandem with cooperating agencies. We commend the agencies' efforts to involve stakeholders, and to seek information at this stage from the myriad of interests, planning processes, cooperating agencies, environmental organizations, the renewable energy development community, utilities, and the public at large.

Defenders is supportive of the Administration's efforts to facilitate responsible renewable energy development. One of the most significant efforts that the administration has put forward in this regard is the BLM's Western Solar Energy Program. To support the success of the program, and to further facilitate directed development, we strongly encourage the Bureau of Land Management (BLM) and US Forest Service (USFS) to prioritize assessment of the WWECs in the Southwest where BLM has identified solar energy zones. In particular, the agencies should prioritize ongoing planning processes including the Las Vegas RMP revision and the California Desert Renewable Energy Conservation Plan (DRECP). Therefore, though our comments and recommendations apply west-wide, our analysis and subsequent comments focus on the California desert and the Southwest region. There are likely additional regional datasets that we have not mentioned that should be included across the West, and we encourage the agencies to conduct a comprehensive review to identify such datasets.

In addition to providing comments and recommendations in response to the questions posed by the agencies on the Section 368 Corridor Study ("Corridor Study") and the Regional Periodic Review ("Review"), Defenders has conducted a coarse-scale GIS-based wildlife risk potential analysis with the aim of identifying potential wildlife risks for each corridor and making subsequent corridor-specific recommendations. This analysis is summarized in Section III of this letter and the full report is included as an attachment to this letter.

I. Section 368 Corridor Study Comments and Recommendations

1. <u>Updates to spatial data</u>

We are very supportive of the Department of the Interior's forthcoming effort to develop a stronger Geospatial Platform (as referenced in the Secretarial Report on Landscape-Scale Mitigation released April 10, 2014) and encourage the WWEC agencies to work with US Fish and Wildlife Service (FWS), USGS, and other agencies to use best-available federal and state information to make decisions related to the maintenance of wildlife connectivity across public lands at the landscape scale. The West-wide Energy Corridor Programmatic Environmental Impact Statement (WWEC PEIS) took a step in this direction by listing the datasets that were used to support mapping and location-specific analyses, and will be nicely supplemented by the GIS data that is anticipated to be collected and used as part of the Corridor Study (Appendix A and B, respectively, of the Final Work Plan for the Section 368 Corridor Study).

Below are comments and recommendations with regards to the datasets listed in these Appendices:

a) *Areas of Critical Environmental Concern*: We support the inclusion of ACECs in location-specific analyses. Further, **we recommend that the agencies avoid siting new transmission facilities in ACECs that were designated specifically for protection of Special Status Species,[2] including but not limited to** the

[2] As described in the Solar PEIS ROD (p74), "Special status species include the following types of species: (1) species listed as threatened or endangered under the ESA; (2) species that are proposed for listing, under review, or candidates for listing under the ESA; (3) species that are listed as threatened or endangered by the state or are identified as fully protected by the state; (4) species that are listed by the BLM as sensitive; and (5) species that have been ranked S1 or S2 by the state or as species of concern by the state or USFWS. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840. These species are included here to ensure broad consideration of species that may be most vulnerable to impacts."

federally listed **desert tortoise.** Desert tortoises are subject to predation by ravens that perch on electric utility wires and new transmission facilities not only increase this threat, they also fragment the habitat. In our analysis (see Sec. III), we looked at where sections of WWEC intersected tortoise-specific ACECs and have made note of this in the section-specific recommendations included in the attached analysis.

b) *Critical habitat for flora and fauna:* We support the use of critical habitat designation data in location-specific analyses of the WWEC. The agencies are required to consult with the FWS under section 7(a)(2) of the Endangered Species Act (ESA) to insure that their actions do not jeopardize listed species or result in the adverse modification of their designated critical habitat. It is worth noting that anticipated revisions[3] to the definition of "critical habitat" and "adverse modification" may give the adverse modification standard a more recovery-oriented definition, in line with recommendations from the National Academy of Sciences regarding interpretation of the standard.[4] **We urge the agencies to consider these upcoming revisions to the definitions of "critical habitat" and "adverse modification" in assessing potential impacts of WWEC corridor designation on critical habitat.**

c) *Migratory bird flyways*: According to the Corridor Study, the agencies anticipate collecting data related to migratory bird flyways for location-specific analyses. **Where data is available on flyways, we support its inclusion. We also recommend the agencies use other information on habitat value for migratory birds such as known stopovers, Important Bird Areas,[5] wetlands, riparian areas, and other datasets. The FWS Land-Based Wind Energy Guidelines provide examples of these types of datasets and analyses for Tier I and II studies.**

d) *Raptor nests*: **We are supportive of the use of available raptor nest data in conducting location-specific analyses of the WWEC considering issues related to bird/power line electrocutions and collisions, and associated bird mortality and power outages.** Considering raptor nest data could help inform siting of utility corridors such that bird mortalities are minimized and energy reliability enhanced. Specifically for the California Condor, the FWS has extensive radio telemetry data that documents flight behavior and patterns of the California Condor. Considering the rarity of this species and the incredible investment already made in their recovery, we urge the agencies to include this data in the Corridor Study.

e) *Potential or designated habitat for listed species:* In addition to federally designated critical habitat, **we support the inclusion of potential or designated habitat for listed species as one of the data sources for the Corridor Study**. **Specifically, we recommend including modeled potential habitat for Mojave and Sonoran desert tortoise.[6]** Both species are threatened by loss and fragmentation of habitat due to human development, and are expected to encounter pressure from increased heat and drought driven by climate change. Desert tortoise will need intact corridors to disperse across the landscape and maintain genetic connectivity in the face of these threats. **For the Corridor Study, the agencies should use datasets on FWS designated Priority 1 and 2 linkages, and tortoise conservation areas for the Mojave desert tortoise. For the Sonoran species, we recommend the agencies use Arizona BLM's tortoise management units, Categories I and II.** In our attached analysis, we used these datasets and have provided siting and management recommendations.

[3] Proposed Rule, Interagency Cooperation-Endangered Species Act of 1973, as Amended, Definition of Destruction or Adverse Modification of Critical Habitat, http://federalregister.gov/a/2014-10503; Announcement of Draft Policy and Solicitation of Public Comment, Policy Regarding Implementation of Section 4(b)(2) of the Endangered Species Act, https://federalregister.gov/a/2014-10502; and Proposed Rule, Listing Endangered and Threatened Species and Designating Critical Habitat, Implementing Changes to the Regulations for Designating Critical Habitat, http://federalregister.gov/a/2014-10504. All published 5/12/2014.
[4] National Research Council. *Science and the Endangered Species Act*. Washington, DC: The National Academies Press, 1995.
[5] National Audubon Society Important Bird Areas – see http://web4.audubon.org/bird/iba/.
[6] While the Sonoran desert tortoise is not listed, the species was determined by FWS to warrant listing; however, the action was precluded by higher priority listing actions. The Sonoran desert tortoise was classified as a Candidate for federal listing in 2010. As a Candidate for federal listing, the Sonoran desert tortoise is a BLM Special Status Species on public land in Arizona.

Additionally, we recommend the agencies consider inclusion of potential or designated habitat for species listed under individual state endangered species acts. For example, in our analysis, we included occupied and potential habitat for Mohave ground squirrel (MGS), a species endemic to the Western Mojave Desert of California. The species has been listed by the state as rare since 1971. With the passage of the California Endangered Species Act in 1998 all rare species were converted to the status of threatened. Transmission lines that intersect the remaining intact patches of MGS native habitat further fragment and isolate populations, and lead to increased illegal off-highway vehicles use of habitat patches. Specifically, we recommend using the habitat model created by Inman et al. (2013).[7] Likewise, **the agencies should look to the recovery plans for state-listed species as these plans often include identified core and connectivity habitat that are important for recovery of a declining or compromised species.**

f) *Potential habitat for special status species*: We support the agencies including data related to potential habitat for special status species, as defined in the Solar PEIS ROD (see footnote 2). **We recommend including data specifically for greater sage-grouse, Gunnison's sage-grouse, bighorn sheep and pronghorn antelope—**however, the agencies should not limit themselves to those species, and should consider a suite of special status species with habitat and connectivity needs that represent a wide range of conservation and management priorities. We selected these species because of their conservation status, sensitivity to disturbance, broad ranges, and need for habitat connectivity and/or unfragmented blocks of habitat.

We recommend the agencies utilize the following for decisions related to siting and management:

- Greater sage-grouse: Use state and/or BLM data on core and priority habitat, as well as FWS-defined Priority Areas for Conservation (PACs).
  Gunnison's sage-grouse: Use "production areas" as designated by Colorado Parks and Wildlife in the Corridor Study. Production areas are typically four-mile buffers around known lek sites which account for the majority of nest sites associated with each lek within the species' range.
- Bighorn sheep: Use data that models landscape permeability to identify those corridors that may disrupt landscape connectivity and impact this species. In California, we recommend the agencies consult with California Department of Fish and Wildlife to identify which WWEC sections intersect key intermountain habitat linkages for Desert Bighorn sheep.
- Pronghorn antelope: Use data that models landscape permeability to identify those corridors that may disrupt landscape connectivity and impact this species.

In addition to those datasets listed in the Appendix A and B of the Corridor Study Workplan, we also encourage the agencies to use the following additional wildlife-specific data to inform the Corridor Study:

a) *State conservation priorities across the landscape*: The Western Governors' Association and its Wildlife Council launched the Crucial Habitat Assessment Tool (CHAT) to "bring greater certainty and predictability to planning efforts by establishing a common starting point for discussing the intersection of development and wildlife."[8] The CHAT is a non-regulatory tool, which each state developed individually using common guidelines and methodologies,[9] and therefore reflects each state's conservation priorities. The tool is intended to be used early on in the planning and evaluation process, to provide landscape-scale information to guide project assessment and siting and identify areas that may warrant a finer-scale analysis. We are very supportive of the overall CHAT effort, and find it extremely valuable as a screening tool. **We recommend that the**

[7] Inman RD, Esque TC, Nussear KE, Leitner P, Matocq MD, Weisberg PJ, Diltd TE, Vandergast AG. (2013) Is there room for all of us? Renewable energy and Xerospermophilus mohavensis. Endang Species Res 20:1-18.
[8] Western Governors' Association Crucial Habitat Assessment Tool. Available at http://westgovchat.org/about.
[9] Western Governors' Wildlife Council White Paper - Version III. Western Governor's Crucial Habitat Assessment Tool (CHAT): Vision, Definitions and Guidance for State Systems and Regional Viewer. July 2013 (Technical Updates Added December 2013). Available at http://www.westgov.org/policies/doc_download/1746-wgwc-white-paper-2013 [Accessed 3/13/2014].

agencies consult closely with the WGA and with individual states to interpret states' conservation priorities as contained in the CHAT.

b) *State Wildlife Action Plans:* While the CHATs are based on spatial analysis conducted for the State Wildlife Action Plans, other aspects of the state plans related to management priorities may not have been included in the geospatial CHATs. **We recommend that the agencies consult with the states on the use of their Wildlife Action Plans to inform corridor designation.**

c) *Recovery Areas:* Under section 7(a)(1) of the ESA, BLM is explicitly obligated to utilize its existing authorities to affirmatively conserve ESA listed species. Section 7(a)(1) is designed to ensure that federal agencies "conserve" listed species, which means to improve the status of a species to the point where it no longer requires the ESA's protection. In order to fulfill obligations under section 7(a)(1), the agencies should consider and as best practicable avoid impacts to geographic areas for recovery units for threatened and endangered species. **We recommend the agencies identify any recovery units for threatened and endangered species and avoid impacting them to an extent that impedes recovery progress.**

d) *California Desert Conservation Area designations:* In addition to BLM ACECs, the BLM in California has designated Wildlife Habitat Management Areas (WHMAs) and Unusual Plant Assemblages (UPAs) in the California Desert Conservation Area (CDCA). Likewise, California Native Plant Society (CNPS) has designated all species in CNPS Category 1B as Sensitive Species. **We recommend that the Corridor Study include datasets on California Native Plant Society Category 1B Sensitive Species, WHMAs and UPAs, especially those UPAs that are classified as Sensitive and Highly Sensitive.**

e) *Landscape permeability and connectivity*: **We recommend the agencies include datasets that map and model landscape permeability[10] and connectivity. Specifically, we recommend using two developed by Theobald et. al.[11] to examine Landscape Permeability and Flowlines of connectivity across the landscape.** Long-term conservation for wildlife will depend on maintaining connectivity across a diversity of ecosystems. Maintaining landscape permeability and connectivity is essential for individual and population-level persistence for many species. Disruption of movement patterns by development can alter ecosystem functions and isolate habitats. For these reasons, maintaining the connectivity and permeability of the landscape is an essential component of Defenders' approach to prevent species and their habitats from becoming imperiled. While states were directed to include a Connectivity or Linkage assessment in developing their CHATs, linkages developed at the state scale may not be applicable at the broader, landscape-scale west-wide. **We recommend the agencies consult closely with Western states to review any other state-level detailed corridor assessments and include those datasets in the Corridor Study.**

In California, **we recommend the agencies include state-wide and California desert-specific connectivity studies: The California Essential Habitat Connectivity Project[12] and A Linkage Network for the California Deserts.[13]** The California Essential Habitat Connectivity Project, completed in 2010, aimed to identify large remaining blocks of intact habitat or natural landscape and model linkages between them that need to be maintained, particularly as corridors for wildlife. The California Desert Linkage Network, conducted by SC Wildlands, identified areas where maintaining or restoring ecological connectivity is essential to conserving California desert's biodiversity.

[10] Landscape permeability is a measure of a species' ability to "percolate" across a connected landscape.
[11] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x
[12] For more information, see California Department of Fish and Wildlife's Connectivity webpage at: http://www.dfg.ca.gov/habcon/connectivity/.
[13] The full report is available for download online at: http://www.scwildlands.org/reports/ALinkageNetworkForTheCaliforniaDeserts.pdf.

In Arizona, **we recommend consulting closely with Arizona Game and Fish Department (AZGFD) to use and interpret new and existing datasets on "Missing Linkages," Landscape Integrity, Intact Habitat Blocks, and other areas important for wildlife movement and connectivity**, which have been under development by the state and many stakeholder, university, and agency partners since 2006.

f) *Regional Transmission Expansion Project (RTEP):* **Use data developed by the Western Electricity Coordinating Council (WECC) in the form of an environmental and cultural risk comparison methodology** developed by the Environmental Data Task Force as part of the Regional Transmission Expansion Project (RTEP), funded by DOE.

g) *DRECP Databasin Gateway:* The Desert Renewable Energy Conservation Plan (DRECP) has generated a huge amount of spatial data that will be used to inform the developing conservation strategy and the identification of Development Focus Areas (DFAs) for the California desert. This data is being shared through the DRECP Databasin Gateway[14] and can be freely accessed. Datasets related to modeled potential habitat for species and natural communities, renewable energy resources and others are available for download. The agencies should use this resource to access data related to the California deserts.

2. Methods for assessing effectiveness of IOPs

As part of the Settlement Agreement, the BLM and USFS also committed to review their existing Interagency Operating Procedures (IOPs), including their utility, pertinent new data, and suggestions from stakeholders for changes to the IOPs. IOPs identify required management procedures that would be incorporated into project-specific energy transport development proposals. The IOPs were incorporated into the land use plan amendments conducted as part of the WWEC Record of Decision. The BLM and USFS also committed to considering new IOPs for specific resources including, but not limited to, wildlife and other natural resource concerns.

The IOPs are meant to "help ensure that energy transport projects within the Section 368 energy corridors are planned, implemented, operated, and eventually removed in a manner that protects environmental resources."[15] Therefore, the ultimate test of the effectiveness of the IOPs is whether they succeed in implementing the mitigation hierarchy at the landscape scale, thereby avoiding, minimizing, and effectively compensating for impacts while at the same time facilitating the responsible development of renewable energy.

In order to test whether permitted development in the WWECs, and indeed the designation of the WWECs themselves, meet these criteria, **the IOPs must embody a rigorous and transparent commitment to monitoring and evaluation**. Evaluation protocols embedded in the IOPs should cover a broad scope of potential actions and impacts: 1) Compliance monitoring to ensure appropriate use of applicable IOPs and design standards; 2) Effectiveness monitoring of compensatory mitigation activities to determine if they are achieving desired results; 3) Regional and local wildlife population monitoring, starting from a pre-construction baseline, to ensure that direct and indirect species impacts remain within the anticipated range; and 4) Habitat quality monitoring, starting from a pre-construction baseline, to test efficacy of IOPs and design standards in protecting nearby habitat from undue fragmentation, siltation, unauthorized vehicle access, and other impacts. Examples of these types of studies can be found in the FWS' Wind Energy Guidelines Tier 3 and 4 study recommendations.[16]

Monitoring findings should be subject to peer review, and yearly reports and associated data, including evaluations of any impact minimization or compensatory mitigation measures implemented, should be published and made publicly available. In addition, all raw data should be provided to the FWS in a timely manner. And, we encourage the project proponent and the state and federal agencies involved to share in what they

[14] DRECP Databasin Gateway, available at drecp.databasin.org.
[15] WWEC Final PEIS p. 2-31.
[16] USFWS (2012). Land-Based Wind Energy Guidelines. Available at http://www.fws.gov/windenergy/docs/weg_final.pdf [accessed 5/5/2014].

learn from the planning, development, and operation of any permitted project within the WWECs with others in the renewable energy industry and the regulatory community.

II. Regional Periodic Review Comments and Recommendations

1. New relevant information

We are supportive of the agencies including in their analysis the new, relevant information listed in the RFI. Below we provide comments on some of this information and recommendations for how it should be used and considered in conducting the Regional Periodic Reviews.

a) *BLM Rapid Ecoregional Assessments (REAs):* REAs compile and analyze existing scientific information to establish baseline conditions and assess changes over time. They represent a snapshot of current and predicted future conditions based both on available data as well as on models that leverage these data. Their purpose is to identify key resource conditions and trends within and across an ecoregion. REAs are not fully standardized in terms of methods across ecoregions and were completed by multiple outside contractors, making generalities about use of outputs from the various REAs difficult. In general, however, when defining relative conflicts of the WWECs, **we recommend BLM consider all data layers from each REA's Data Catalog Appendix to determine which should be considered with a focus on those related to habitat intactness and habitat value (both current and predicted) for key species. In cases where a key species would lose current, high value habitat or habitat predicted to be important for future climate change resiliency, avoidance should be prioritized**.

b) *Sage-grouse conservation*: We note that the WWECs not only have the potential to impact greater sage-grouse, but also other grouse species and populations such as Gunnison sage-grouse and the bi-state Distinct Population Segment of sage-grouse in California and Nevada. Particular care must be taken to avoid, minimize, and compensate for impacts to these small, isolated populations of grouse. **The most important conservation recommendations for sage-grouse[17] are those contained in the FWS' Conservation Objectives Team (COT) Report[18] to avoid energy development in Priority Areas for Conservation (PACs) and the BLM National Technical Team (NTT) Report to "exclude energy development and other large-scale disturbances from priority habitats."[19] The NTT report also recommended making priority sage-grouse habitats exclusion areas for new ROWs permits, with possible exceptions related to co-locating the new project footprint within an existing disturbance area. Finally, the NTT report recommended that the BLM "evaluate and take advantage of opportunities to remove, bury, or modify existing power lines within priority sage-grouse habitat areas."[20] In the case of the bi-state sage-grouse, due to its isolation and declining population status, we recommend that the NTT report recommendations apply not only to "core" breeding areas but to *all* breeding, nesting, and brood-rearing areas.**

c) *BLM Solar Energy Program:* It is essential that the WWECs support the development of renewable energy, including utility-scale solar energy in the Solar Energy Zones (SEZs) identified in the BLM's Solar Energy Program. While many SEZs in California, Arizona, southern New Mexico, Nevada, and Utah benefit from

[17] We note the agencies' intent to include several other sage-grouse conservation strategies, including the Wyoming sage-grouse strategy. We do not support the use of this strategy as its recommendations are inadequate to conserve sage-grouse and inconsistent with the BLM's own guidance for managing the species' habitat.
[18] U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013.
[19] Bureau of Land Management Sage-grouse National Technical Team. 2011. A Report on National Greater Sage - Grouse Conservation Measures. December 21, 2011.
[20] Id.

proximity to WWECs, those in southern Colorado and northern New Mexico largely do not. **When revising WWEC designations, prioritize access to transmission for SEZs identified via the Solar Energy Program.**

d) *BLM AZ RDEP:* BLM Arizona's Restoration Design Energy Project (RDEP) contains a number of innovations that should be incorporated into the Regional Periodic Reviews**. In Arizona, the agencies should prioritize routing corridors that support the Renewable Energy Development Areas (REDAs) identified in RDEP. Corridor designation in Arizona should use the GIS screens developed for the RDEP process to identify areas to avoid in transmission corridor siting. Most importantly for the west-wide nature of the energy corridors, the BLM and USFS should adopt RDEP's practice of extending analysis and screening for development areas onto private, state, and county lands as well as federal lands.** While such analysis would not be decisional, it would provide valuable information for future developers as they plan how to site projects within the WWECs.

e) *Desert Renewable Energy Conservation Plan:* It is essential that the agencies consider the on-going landscape-scale planning effort of the DRECP in the Regional Periodic Reviews of the WWECs. The DRECP aims to identify areas for renewable energy development that minimize impacts to wildlife and natural resources. In that regard, transmission needs to be prioritized to serve these areas and not serve areas that will be incorporated as the conservation strategy for the CA deserts. **In evaluating the WWECs, we encourage the agencies to work closely with the Renewable Energy Action Team in California to ensure compatibility with the DRECP planning process.**

2. Identification of new requirements

a) *Offsite Regional Mitigation Policy*: **The BLM should follow the Offsite Regional Mitigation Policy and the direction outlined in Secretarial Order 3330 and the subsequent Report to the Secretary of the Interior, *A Strategy for Improving the Mitigation Policies and Practices of The Department of the Interior.*[21]** The Report identifies 10 principles for landscape-scale mitigation, which are to guide all future Department mitigation policies and procedures. The West-Wide Energy Corridors Corridor Study and Regional Periodic Review represent an exciting early opportunity for the BLM, in particular, to explicitly incorporate these principles into the development of an effective, coordinated, landscape-scale approach to planning for future transmission line siting *and* conservation across the Western landscape.

Adopting a landscape approach would allow public land agencies, renewable energy developers, and other stakeholders to identify up front strategies to (1) avoid development in sensitive wildlife habitats including crucial wildlife habitats and corridors; (2) direct development to, and incentivize development in, areas with excellent renewable energy resources and the lowest possible conflicts with conservation values; (3) minimize impacts on-site through project-specific requirements; and (4) when remaining unavoidable impacts warrant mitigation, off-set impacts with effective and durable off-site, compensatory mitigation that advances specific and measurable conservation goals for the identified landscape by protecting, restoring and improving management of high-value, sensitive wildlife habitats. By establishing development and conservation goals and objectives upfront, land management and wildlife agencies can strategically determine whether and how development can be effectively mitigated such that the landscape can sustain its ecological systems, functions, and values. Such an approach avoids the redundancies and expense of a administering a project-by-project analysis and provides greater certainty that critical conservation and renewable energy objectives can be met.

b) *2012 Forest Planning Rule*: The Regional Periodic Reviews must be consistent with the 2012 Planning Rule under the National Forest Management Act (NFMA) so that any subsequent revisions to the Land Management Plans (LMPs) are in line with the 2012 Rule and associated USFS Manual and Guidance. The purpose of the 2012 Rule is to guide development of plans that will "promote the ecological integrity of

[21] Available at http://www.doi.gov/news/upload/Mitigation-Report-to-the-Secretary_FINAL_04_08_14.pdf [accessed 4/22/2014].

national forests and grasslands,"[22] including an emphasis on conserving biological diversity. The 2012 Rule was developed following policy set at the Chief and Secretarial level to use an "All Lands Approach," recognizing the interconnected nature of America's forests, wildlife, and natural resources across the landscape.[23,24] **Specifically, the Reviews should provide enough information to fulfill the *assessment* portion of the planning framework established under Section 219.5 of the 2012 Rule, which will inform site-specific NEPA analysis that would underlie any LMP amendments for infrastructure proposed in the WWECs**. In order to determine whether plan components provide ecological conditions to maintain the diversity of plant and animal communities, an assessment must ensure that information is provided about those conditions.

3. Identification of Regional Stakeholder Fora

We support the agencies' interest in conducting stakeholder outreach and engagement via existing regional for a such as Resource Advisory Councils, the Western Electric Coordinating Council, Landscape Conservation Cooperatives, the WFA, and the Indian Country Energy and Infrastructure Working Group. **In addition, we recommend the BLM and USFS reach out to the following regional bodies that provide venues for joint industry and conservation community participation in renewable energy and conservation planning. Defenders of Wildlife is a member or participant in each of these fora:**

a) *California Desert Renewable Energy Working Group* (CDREWG)*:* The CDREWG is a stakeholder driven dialogue between representatives of the renewable energy industry, the electric utility sector, and the environmental community that seeks to protect ecosystems, landscapes, and species while supporting the timely development of renewable energy resources in the California desert. Since 2009, the group has been working together to improve planning and permitting for large-scale solar energy development on public lands in the California desert.

b) *Arizona Solar Working Group (ASWG):* The ASWG was assembled to promote dialogue and collaboration between conservation and wildlife organizations, renewable energy advocates, utilities, and solar developers working towards a sustainable energy future. The ASWG believes it is important to look holistically when developing generation and transmission projects to ensure that they are planned and built to avoid and minimize impacts on the state's magnificent lands and wildlife. **The group meets regularly in Phoenix, AZ, and has invited the BLM and USFS staff to participate in a listening session on the WWECs hosted by the ASWG.**[25]

c) *Oregon Governor's SageCon Partnership*: Governor Kitzhaber established the Sage Grouse Conservation Partnership ("SageCon") to design and implement the "All-lands, All-threats" plan across the state. The Partnership coordinates federal, state, and local efforts, including the involvement of numerous conservation groups and wind energy companies, convened by the Governor's office and the BLM. SageCon is working to align the partners' conservation strategies and regulatory requirements and develop a shared governance structure for future management decisions. **Because of the threat posed by transmission line development to greater sage-grouse in eastern Oregon, we recommend the BLM and USFS engage with the SageCon partnership over the course of the Regional Periodic Review.**

[22] 36 CFR 219.1(c)
[23] USFS (date unknown). "Draft All-Lands Approach for the Proposed Forest Service Planning Rule." http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182029.pdf [accessed 5/12/2014].
[24] Forest Service Chief Tom Tidwell (1/13/2010). "An All-Lands Approach to Conservation." Speech given to the Western States Land Commissioners Association, Winter 2010 Conference, Little Rock, AR. http://www.fs.fed.us/news/2010/speeches/01/conservation.shtml [accessed 5/12/2014].
[25] Comments Re: Recommendations Related to the Request for Information: West-wide Energy Corridor Review. Submitted May 27, 2014 by the Arizona Solar Working Group.

4. Improvements to Interagency Operating Procedures (IOPs)

We recommend the following improvements to the IOPs:

a) *Use the Full Mitigation Hierarchy across the Landscape*:

One of the first and most important steps to **avoid as many impacts as possible to sensitive resources** is to plan potential transmission lines so that they are developed within existing and designated corridors, ROWs, brownfields and other degraded lands, and other areas with co-locating opportunities. Equally important is planning to avoid lands within the categories that are either statutorily protected from development and those that should otherwise be avoided, such as greater sage-grouse core areas. The Corridor Review Study, if well-executed, should address many of these issues.

The categories of protected areas are well-known and their locations are included in a number of available geospatial data sets, which makes it easier to plan avoidance of these important lands even prior to NEPA siting activities. The BLM has identified the following categories of lands with "high potential for conflict" where complexity of risks and concerns may make it difficult to resolve issues or where it "may not be feasible to authorize"[26] a wind or solar ROW, for example:

- Lands near or adjacent to lands designated by Congress, the President, or the Secretary for the protection of sensitive viewsheds, resources, and values (e.g., units of the National Park System, Fish and Wildlife Service Refuge System, National Forest System, and the BLM National Landscape Conservation System), which may be adversely affected by development;
- Lands adjacent to Wild, Scenic and Recreational Rivers and river segments determined eligible/suitable for Wild or Scenic River status if project development may have significant adverse effects on sensitive viewsheds, resources, and values;
- Designated critical habitat for federally threatened and/or endangered species if project development is likely to result in the destruction or adverse modification of that critical habitat;
- Lands currently designated as Visual Resource Management Class I or Class II;
- Right-of-way exclusion areas;
- Lands currently designated as no surface occupancy (NSO) in BLM land use plan prescriptions.

Less protected are important wildlife movement corridors, landscape connections, and crucial wildlife habitats and are threatened by many types of development throughout the West, including transmission. These corridors and connections are crucial to the current and long-term viability of game and nongame wildlife, especially as they provide adaptation options in the face of a changing climate. Depending on the wildlife and landscape, transmission can contribute to loss, fragmentation, and diminished resiliency of these habitats. Our recommendations on additional datasets to consider (above) as well as the results of our geospatial analysis (see Sec. III) can contribute to an understanding of these resources. The benefit of avoidance is not only for the particular species or habitat considered, but all will expedite the federal environmental review process and reduce cost and conflict.

The use of strong IOPs and Best Management Practices can help **minimize impacts to wildlife and connectivity** from transmission corridor designation. There are numerous resources with additional information on best practices that we recommend reviewing and incorporating into the existing IOPs. These include, but are not limited to the following:

- The Avian Power Line Interaction Committee's "Suggested Practices for Avian Protection on Power Lines" available at: http://www.aplic.org/uploads/files/2643/SuggestedPractices2006(LR-2).pdf;
- Edison Electric Institute's "Mitigating Bird Collisions with Power Lines" available at: http://www2.eei.org/products_and_services/descriptions_and_access/mitigating_birds.htm

[26] BLM IM 2011-061, "Solar and Wind Energy Applications—Pre-Application and Screening."

- Western Resource Advocates' "Smart Lines" report, available at: http://www.westernresourceadvocates.org/energy/smartlines.php; and
- Wild Utah Project's "Best Management Practices for Siting, Developing, Operating and Monitoring Renewable Energy in the Intermountain West" available at: http://wildutahproject.org/files/images/BMP%20for%20Renewable%20Energy-2012-WUP.pdf

Any unavoidable impacts following avoidance and minimization measures must be compensated for. We have provided extensive recommendations to the BLM, in particular, on **compensatory mitigation** in comments on the Draft Handbook on Offsite Mitigation,[27] the Dry Lake Solar Energy Zone Regional Mitigation Strategy,[28, 29] the Sage Grouse Habitat Equivalency Analysis (HEA) for the Gateway West Transmission Project,[30] and the Supplement to the Solar Programmatic Draft Environmental Impact Statement.[31] We hereby incorporate those comments by reference.

We recommend the agencies review and revise all IOPs with an eye to fulfilling mitigation obligations and policies, many of which were developed since the original corridor designation.

b) *Transmission Planning Principles.*

In general, we believe the following principles should guide all federal decision-making on transmission policy and practices:

- **Full consideration of non-wires alternatives to ensure the grid is planned efficiently**. Fully consider non-wires alternatives to generation and transmission during transmission planning. The Western Electricity Coordinating Council is studying transmission cases where all economic energy efficiency, distributed generation and demand side management (DSM), and expansion of existing DSM programs (high DSM case), are considered in estimating loads and the need for future transmission.[32] Forecasts of congestion and grid optimization need to incorporate these assumptions. By prioritizing non-wires solutions, and focusing on the development of transmission projects that are truly needed, we can avoid delays and wasted resources expended unnecessarily.

- **Robust early planning for new transmission needed to unlock renewable energy**. Shipping power from renewable energy generation sites to load centers is only part of a comprehensive approach. Nevertheless, new transmission will be needed to serve remotely constrained renewable energy resources, and these proposals should be prioritized over transmission serving remotely located carbon fueled generation. In addition, to avoid delays, planners should prioritize alternatives with fewest environmental and cultural conflicts in their effort to resolve congestion, ensure reliability, and simplify permitting. Utilizing the comparative methodology from WECC's environmental data task force (EDTF) for transmission alternatives is a good first step towards early identification of potential impacts to environmental and cultural resources. The EDTF methodology is intended to use geospatial and stakeholder identified data and evaluation to score transmission alternatives regarding their relative environmental and cultural risk.

[27] Defenders of Wildlife (1/17/2014). Comments RE: "BLM Interim Policy, Draft Regional Mitigation Manual Section-1794."
[28] Defenders of Wildlife (5/16/2013). Comments RE: "Draft Solar Regional Mitigation Strategy for the Dry lake Solar Energy Zone," and "Draft Technical Note: Procedural Guidance and Framework for Developing Solar Regional Mitigation Strategies."
[29] The Nature Conservancy, The Wilderness Society, and Defenders of Wildlife (5/16/2013). Comments Re: "Draft Solar Regional Mitigation Strategy for the Dry Lake Solar Energy Zone," and "Draft Technical Note: Procedural Guidance and Framework for Developing Solar Regional Mitigation Strategies"
[30] Defenders of Wildlife, The Wilderness Society, and the National Audubon Society (8/3/2012). RE: Comments on the Sage Grouse Habitat Equivalency Analysis (HEA) for the Gateway West Transmission Line Project.
[31] Defenders of Wildlife and the Sierra Club (1/27/2012). RE: Comments on the Notice of Availability of the Supplement to the Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States. 76 Fed. Reg. 66958 (Oct. 28, 2011)
[32] Ideally "economic" energy efficiency criteria should include avoided environmental costs of supply-side solutions.

- **Make smart investments in efficient transmission expansion**. Making full use of existing transmission infrastructure, corridors, and ROWs will enable more rapid development of transmission to serve remotely constrained renewable generation. Such options include reconductoring existing lines to increase capacity and reduce losses; upgrading substations in key locations; reconstructing (when reconductoring is an inadequate solution) lines to higher voltage ratings within existing corridors; reviewing and modifying regulatory standards to allow for greater use of existing corridors; and evaluating additional transfer capacity in the system from retiring coal plants to enable greater use by renewable generation projects. These options should be utilized in advance of any new corridor designations.

- **Ensure new infrastructure investments are "right-sized"**. In new and existing corridors, transmission resources should be made scalable and consolidated wherever possible so that fewer corridors will be needed in the future. Examples of this would be constructing a tower to which an additional circuit could later be added, or for which a higher voltage rating could be obtained through reconductoring at a later time, or seeking to co-locate multiple infrastructure projects within a single corridor. Efficiently scaling transmission reduces permitting delays in the future and will significantly reduce fragmentation impacts on wildlife habitat.

We recommend the agencies incorporate the above transmission planning principles that prioritize reducing the impact of new infrastructure on the landscape, by for example considering non-wire alternatives to a new corridor segment or requiring reconductoring or other design features rather than new construction.

c) *Incorporation of Solar Energy Program Design Features*

The Solar PEIS included "Design Features" that were intended to achieve the same outcomes as the IOPs – avoiding, minimizing, and/or mitigating the potential adverse effects of solar energy development. While the Design Features were developed to address solar energy development, most of them are applicable for transmission development as well. The value of the Solar PEIS Design Features lies in their level of detail and specificity with regard to procedures and resources, the addition of which would greatly strengthen the WWEC IOPs. **We recommend that the BLM and USFS incorporate the Design Features from the Solar PEIS into the WWEC as IOPs. The BLM and USFS should also create specific IOPs for individual WWEC or segments of WWEC that are most likely to be developed to address specific resource issues there.** The Solar PEIS Design Features are included as Attachment 2.

d) *Include a landscape-scale assessment of critical habitat impacts*

While it is important to identify where WWEC sections intersect designated critical habitat as part of the Corridor Study, we suggest that the agencies also consider critical habitat that does not intersect, but is within a distance of a WWEC segment such that fragmentation, siltation, and other impacts could potentially result in adverse indirect impacts to covered species or adverse modification of critical habitat. In our analysis, we identified critical habitat designations within 2 km of the WWEC segments in order to identify the potential for such occurrences. **Wherever a WWEC section is near critical habitat such that impacts could occur, the IOPs should call for consultation with USFWS to avoid potential adverse modification to designated critical habitat.**

III. Recommendations on Data and Methodology for Regional Periodic Reviews

In addition to responding to the questions presented in the RFI, Defenders conducted a coarse-scale, transparent, replicable, and quantitative GIS-based wildlife risk assessment to approximate wildlife habitat value for each corridor, rank corridors by risk, and provide detailed, corridor-specific recommendations. The full analysis including methodology, data sources and comprehensive recommendations, including for specific corridors, is included as Attachment 1.

Our analysis includes both coarse-scale and fine-scale data for selected species. Four coarse-scale, west-wide data sets were used in order to generate comparable scores for each WWEC segment: state Crucial Habitat Assessment Tool (CHAT) values,[33] landscape permeability (a model of habitat connectivity),[34] "flowlines" (a model of preferred routes across the landscape connecting permeable habitat),[35] and occurrences of NatureServe ranked G-1 and G-2 (globally imperiled) species by watershed.[36] Additionally, we examined several fine-scale, individual key species datasets and maps, including desert tortoise, Mohave ground squirrel, bighorn sheep, Greater sage grouse, and Gunnison sage grouse. Finally, we took a close look at potential impacts in southern California and the Mojave Desert, an area of particular focus for Defenders of Wildlife. Here, in addition to the fine-scale species-specific datasets described above, we examined the WWECs' interactions with Southern California Wildland's "A Desert Linkage" wildlife linkages models.[37]

These analyses, especially those using the coarse-scale, west-wide datasets, are meant to serve as examples of how currently available wildlife species and habitat data, many of which were not available at the time of the original WWEC PEIS, can be used to identify segments and portions of segments likely to be of particularly high (or low) risk to wildlife for further analysis. The Regional Periodic Reviews must incorporate both coarse-scale and fine-scale special-status species information to:

- Avoid impacts by re-aligning or removing corridors with particularly high risk potential,
- Minimize impacts by strengthening IOPs and incorporating the use of wildlife-specific Best Management Practices (BMPs) and design features that would apply where datasets indicate wildlife risk is likely to be present, and
- Direct development of energy transmission infrastructure to those corridors deemed low risk, and compensate for any remaining site-specific impacts.

Our analytical approach estimates the conservation value of each WWEC by comparing available landscape prioritizations: it is not intended to replace an integrated analysis that would draw in all key data sources to produce a synthetic metric of "wildlife risk" for each segment. The purpose of our analysis was to identify high-risk corridors for further investigation.

To make results easier to interpret, we divided each of the four scores into categories of Very High, High, Medium, Low, and Very Low relative risk. A table of results for all scores and analyses for each segment, color-coded by risk category and ordered from highest to lowest statistical risk across all four categories is included in the attached analysis.

We have attached the full report to this letter, however, have included here a summary of the recommendations and conclusions from our analysis.

[33] Western Governors' Association Crucial Habitat Assessment Tool. Available at http://westgovchat.org/about.
[34] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x
[35] Ibid.
[36] NatureServe Analysis of Imperiled or Federally Listed Species by HUC-12, October 2011. Note that this dataset, while extremely valuable in its detailed aggregation at the HUC-12 watershed level, does not represent the most recent available information from NatureServe (which updates its HUC-8 datasets more frequently). We used it in our analysis to provide a west-wide window onto local concentrations of imperiled species, but WWEC-specific analysis should identify best-available datasets in order to get a comprehensive understanding of potential impacts to imperiled species.
[37] Penrod, K., P. Beier, E. Garding, and C. Cabañero. 2012. A Linkage Network for the California Deserts. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/.

1. Overall Recommendations for Corridor Study and Regional Periodic Reviews

a) *Analytical Recommendation:*

- **Conduct a rigorous, transparent, replicable, and data-driven analysis of wildlife risk and impacts to inform infrastructure decision-making throughout the West.** While our analysis was not intended to replace an integrated analysis that would draw in all key data sources to produce a synthetic metric of "wildlife risk" for each segment, we see the development of such methods, possibly in concert with an academic institution or USGS, as a required element for BLM's further examination of the WWECs. In addition, this effort could be seen as a pilot project in fulfillment of the Department of the Interior's plan to develop a geospatial tool for resource management across public lands, as identified in the Report to the Secretary on Landscape-Scale Mitigation (April 2014). We look forward to seeing the results of this additional, needed research.

b) *GIS Recommendations*:

- **Determine a biologically meaningful scale of analysis, supported by available datasets, to break up WWECs into sub-segments and thereby facilitate much finer-scaled analysis, routing recommendations, and decision-making.** WWEC segments vary from 3.87 to 394.87 km in length, making it extremely difficult to provide segment-specific recommendations using geospatial information. For instance, the West-Wide CHAT contains hexagons of 3 to 5 km in diameter. Without such a standardized analysis, and without well-documented metadata for the ad-hoc sub-segment divisions that were produced by overlaying with other management datasets, we were unable to target our analysis and recommendations more specifically than the segment-wide scale.
- **Make available information on which sub-segments contain actual existing infrastructure (transmission, pipelines, roads, and other infrastructure covered by the WWEC PEIS and Review Study), not just existing ROWs.** We were unable to determine which WWEC segments contained existing infrastructure (not just existing ROWs, as was available in the GIS data).

c) *Existing Corridors Recommendation*: As described above, we were unable to determine which WWEC segments contained existing transmission and pipeline infrastructure. Therefore, while we have a strong preference for "right-sizing" corridors and using existing infrastructure, we were unable to make corridor-specific recommendations using that information and the majority of our recommendations below assume new construction.

- **Therefore, where we recommend avoidance of risk to a resource, the BLM may achieve that goal in many cases either by re-routing the corridor *or* by clarifying sub-segment-specific requirements (including within the GIS) for upgrades, bundling developments together in a narrow width, forbidding multiple access roads, etc., in accordance with the Transmission Planning Principles described above.**

2. Recommendations on the Use of Datasets to Modify Corridor Segments

The table below shows how we applied our analytical framework (described in more detail in the attached analysis) to the individual WWEC segments to produce segment-specific recommendations. Those recommendations are included as Appendix B to the attached report, which we hereby incorporate by reference.

Corridor of concern	Re-route to avoid resources identified as "of concern."
Close to or intersects with Critical Habitat	Consult with USFWS to avoid adverse modification to designated critical habitat.

CHAT risk score	Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.
Permeability risk score	Reroute to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.
Flowlines risk score	Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.
Imperiled Species risk score	Consult closely with state fish and game agencies and the US Fish and Wildlife Service to ensure that valuable wildlife resources are protected from the "Very High" risk to Imperiled Species posed by this segment. Identify and where present avoid impacts to geographic areas for recovery units for threatened and endangered species.
Greater Sage-grouse core areas	Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.
Gunnison Sage-grouse production areas	Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.
Sonoran Desert Tortoise habitat	Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.
Tortoise Conservation Areas	Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs.
Mojave Desert Tortoise Priority 1 & 2 Connectivity Habitat	Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of P1 & P2 habitat.
Desert Bighorn Sheep habitat	Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert.
SC Wildlands Linkage	If a corridor segment intersects a Southern California Wildlands Linkage, see general recommendations for maintaining connectivity in this region.
Mohave Ground Squirrel modeled habitat	Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible.

IV. Conclusion

Thank you for the opportunity to provide these recommendations, and the attached report, as information to the BLM and USFS as you conduct the WWEC Corridor Study and design the Regional Periodic Review process. We commend the agencies' efforts to involve stakeholders and to seek external information, and thank you for considering these comments. We believe this opportunity to revisit the WWECs represents a chance to incorporate forward-looking concepts of landscape-scale assessment, planning, and mitigation as we plan our nation's renewable energy future. We look forward to continuing our work and engagement with the agencies, and would welcome further dialogue on any of the issues raised in this letter or the attached analysis.

Sincerely,

Jon Belak
Wildlife Biologist, Renewable Energy
Defenders of Wildlife

Stephanie Dashiell
California Representative
Defenders of Wildlife

Eliza Cava
Policy Analyst, Renewable Energy & Wildlife
Defenders of Wildlife

Anderson Shepard
Conservation Science & Planning Analyst
Defenders of Wildlife

Attachment 1: GIS Risk analysis of WWECs, including corridor-specific recommendations

Attachment 2: Solar PEIS ROD Design Features

CC: Stephen Fusilier, Transmission and Energy Corridor Program Lead, BLM

GIS Risk Analysis of the West-Wide Energy Corridors (WWECs)

Defenders of Wildlife

May 2014

Jon Belak, Eliza Cava, Stephanie Dashiell, Anderson Shepard

Thanks to: Jeff Aardahl, Chris Haney, Julie Falkner, Erin Lieberman, Jake Li, Pete Nelson, and Mark Salvo

Contact: ecava@defenders.org. Data tables available digitally upon request.

Table of Contents

Introduction and Executive Summary

Defenders of Wildlife is working to address the threat of climate change by advocating for significant increases in renewable energy and energy conservation measures, while conserving our wildlife and natural resources. We recognize that well-sited transmission is needed across the West to connect load centers to renewable energy resources and enhance grid reliability and reduce congestion in order to increase its ability to incorporate variable renewable resources.

As directed by Section 368 of the Energy Policy Act of 2005, the Bureau of Land Management (BLM) and US Forest Service (USFS) undertook a programmatic environmental impact statement (PEIS) designating right-of-way (ROW) corridors across public lands in eleven Western states in order to streamline and facilitate the siting of linear energy infrastructure (pipelines and transmission lines). However, the original corridor designations, proposed in 2009, did not do enough to connect renewable (rather than fossil fuel-generated) energy to towns and cities, did not provide enough opportunity for public input on their construction, and did not adequately analyze potential impacts on wildlife and the environment. In response, Defenders joined fellow conservation organizations and one county in challenging the designation of the originally proposed corridors. The litigation resulted in a settlement agreement, in which the agencies agreed to review the corridors to address these issues. Pursuant to the settlement agreement, the agencies developed a work plan for initiating a Corridor Study to assess the overall usefulness of the corridors and review corridor placement, utilization, and the use of Interagency Operating Procedures. Following the Corridor Study, the agencies will initiate the first Regional Periodic Review of corridor designations, and develop a corridor monitoring plan to support the study.

In response to the above developments, Defenders of Wildlife undertook a transparent, replicable, and quantitative geospatial study to assess the wildlife risk potential of the original West-Wide Energy Corridors (WWECs) with the aim of identifying potential risks for each corridor and making subsequent corridor-specific recommendations. We also aim to provide the agencies with the methodologies we used to better understand potential wildlife impacts on a programmatic scale, and encourage the agencies to further develop their own analyses to inform future corridor siting. This analysis supports our recommendations contained in our letter to the BLM and USFS in response to their request for information to support the Corridor Study and Regional Periodic Review of the WWECs (79 Fed. Reg. 17567, 3/28/14). Our letter also contains additional recommendations on transmission planning and siting principles, informed by our work examining transmission and renewable energy projects over the past several years.

This report presents our GIS analysis of the WWECs, which includes both coarse-scale and fine-scale data for selected species. Four coarse-scale, west-wide data sets were used in order to generate comparable scores for each WWEC segment: state Crucial Habitat Assessment Tool (CHAT) values,[1] landscape permeability (a model of habitat connectivity),[2] "flowlines" (a model of preferred routes across the landscape connecting permeable habitat),[3] and occurrences of NatureServe ranked G-1 and G-2 (globally imperiled) species by watershed.[4] Additionally, we examined several fine-scale, individual key species datasets and maps, including desert tortoise, Mohave ground squirrel, bighorn sheep, Greater sage grouse, and Gunnison sage grouse. Finally, we took a close look at potential impacts in southern California and the Mojave Desert, an area of particular focus for Defenders of Wildlife. Here, in addition to the fine-scale species-specific datasets described above, we examined the WWECs' interactions with Southern California Wildland's "A Desert Linkage" wildlife linkages models.[5]

These analyses, especially those using the coarse-scale, West-wide datasets, are meant to serve as examples of how currently available wildlife species and habitat data, many of which were not available at the time of the original PEIS, can be used to identify segments and portions of segments likely to be of particularly high (or low) risk to wildlife for further analysis. Additional research on identified segments would provide the basis for agencies to fulfill Interior

[1] http://westgovchat.org/about.

[2] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x

[3] Ibid.

[4] NatureServe Analysis of Imperiled or Federally Listed Species by HUC-12, October 2011.

[5] Penrod, K., P. Beier, E. Garding, and C. Cabañero. 2012. A Linkage Network for the California Deserts. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/.

Secretarial Order 3330, which prioritizes a landscape-scale approach to mitigation with an emphasis on identifying ways to avoid impacts to wildlife and natural resources, minimize those that cannot be avoided, and offset any remaining impact. The agencies' detailed WWEC analysis encompassed in the Corridor Review must incorporate both coarse-scale and fine-scale special-status species information to:

- Avoid impacts by re-aligning or removing corridors with particularly high risk potential,
- Minimize impacts by strengthening Interagency Operating Procedures (IOPs) and incorporating the use of wildlife-specific Best Management Practices (BMPs) and design features that would apply where datasets indicate wildlife risk is likely to be present, and
- Direct development of energy transmission infrastructure to those corridors deemed low risk, and compensate for any remaining site-specific impacts.

Our analytical approach estimates the conservation value of each WWEC by comparing available landscape prioritizations: it is not intended to replace an integrated analysis that would draw in all key data sources to produce a synthetic metric of "wildlife risk" for each segment. However, we see the development of such transparent, quantitative, and replicable methods, possibly in concert with an academic institution or USGS, as a required element for BLM's further examination of the WWECs. In addition, this effort could be seen as a pilot project in fulfillment of the Department of the Interior's plan to develop a geospatial tool for resource management across public lands, as identified in the Report to the Secretary on Landscape-Scale Mitigation (April 2014). The purpose of our analysis was to identify high-risk corridors for further investigation, and we look forward to seeing the results of this additional, needed research.

To make results easier to interpret, we divided each of the four scores into categories of Very High, High, Medium, Low, and Very Low relative risk. A table of results for all scores and analyses for each segment, color-coded by risk category and ordered from highest to lowest statistical risk across all four categories is included in the attached report.

Appendix A contains our maps and results, Appendix B contains our corridor-specific recommendations, and Appendix C contains our methodology for conducting the geospatial risk analysis that underlies our recommendations.

Coarse-Scale Risk Analysis

Background and general methods for our West-wide, coarse-scale GIS analyses are shown below. Quantitative results and maps are shown in Appendix A for all coarse-scale analyses. Detailed methodologies are shown in Appendix C.

State conservation priorities across the landscape

The Western Governors' Association and its Wildlife Council launched the Crucial Habitat Assessment Tool (CHAT) to "bring greater certainty and predictability to planning efforts by establishing a common starting point for discussing the intersection of development and wildlife."[6] The CHAT is a non-regulatory tool, which each state developed individually using common guidelines and methodologies,[7] and therefore reflects each state's conservation priorities. They are intended to be used early on in the planning and evaluation process, to provide landscape-scale information to guide project assessment and siting and identify areas that may warrant a finer-scale analysis. West-wide CHAT layers are provided in generalized hexagons of either 3 or 5 km diameters, and include conservation priorities not only for Species of Greatest Conservation Need but also for Species of Economic and Recreational Importance, as well as other values, not all of which are available for public analysis in the West-Wide CHAT database. Therefore, while we are very supportive of the overall CHAT effort, and find it extremely valuable as a screening tool, it will be important for the BLM and USFS to consult closely with the WGA and with individual states to interpret states' conservation priorities, even where our analysis found a relatively high CHAT risk score.

The final CHAT rank ranges from a high of 1 to a low of 6, and we assigned each WWEC segment a **CHAT "risk score"** from 0-10 (where 10 is high) based on that underlying data.

Recommendation: We encourage the agencies to view "Very High" (top priority) and "High" WWEC segment CHAT risk scores as places where they should proceed with caution, and work with state fish and game agencies and the Western Governors' Association to implement the full mitigation hierarchy of avoid, minimize, and where appropriate compensate for the resources potentially at risk. In conjunction with state wildlife agencies, consider revision of corridor route or requirement of locally-specific best management practices (BMPs) to minimize impacts.

Landscape permeability and connectivity

Wild animals need many resources to thrive, but one of the most important is space. Migratory species need to be able to roam the landscape from wintering to breeding grounds, and without habitat connectivity between these areas, these species cannot persist. More localized species need to be able to gradually shift their populations over time, in response to changes in climate, predation, development, or other factors, and must be able to encounter other populations of the same animal to maintain genetic diversity. Many western species are intolerant of disturbance, and therefore require large, contiguous blocks to buffer their preferred habitat from encroachment by development. For all of these reasons, maintaining the connectivity and permeability of the landscape is an essential component of Defenders' approach to prevent species and their habitats from becoming imperiled. We used two datasets developed by Theobald et. al.[8] to examine **Landscape Permeability** (a measure of species' ability to "percolate" across a connected landscape) and **Flowlines** of connectivity across the landscape, and assigned each WWEC segment a "risk score" from 0-10 based on the underlying data.

While states were directed to include a Connectivity or Linkage assessment in developing their CHATs, linkages developed at the state scale may not be applicable at the broader, landscape scale West-wide. The BLM and USFS have a responsibility to manage West-Wide and should use additional, appropriately scaled datasets. We are very supportive of the Department of the Interior's forthcoming effort to develop a stronger Geospatial Platform (as referenced in the

[6] http://westgovchat.org/about.
[7] Western Governors' Wildlife Council White Paper - Version III. Western Governor's Crucial Habitat Assessment Tool (CHAT): Vision, Definitions and Guidance for State Systems and Regional Viewer. July 2013 (Technical Updates Added December 2013). Available at http://www.westgov.org/policies/doc_download/1746-wgwc-white-paper-2013 [Accessed 3/13/2014].
[8] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x

Secretarial Report on Landscape-Scale Mitigation released April 10, 2014) and encourage the WWEC agencies to work with USFWS, USGS, and other agencies to use best-available federal information to make decisions related to the maintenance of connectivity across public lands at the landscape scale.

Recommendation: The agencies should consider datasets that describe landscape-scale measures of connectivity, such as those developed by Theobold et al, to assess the impact that corridor designations might have on this crucial habitat function.

Recommendation: Where our analysis' scores for Permeability rank "Very High" (top priority) and "High" risk, work closely with state and federal wildlife and science agencies, including the USGS, to ensure that connectivity is maintained. Avoid siting corridors in areas of high permeability.

Recommendation: Where our analysis' scores for Flowlines rank "Very High" (top priority) and "High" risk, prioritize avoidance to reduce the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity through the use of locally appropriate crossing structures, underground line construction, and other best management practices.

Threatened and Endangered Species

The revised corridor designations should be consistent with BLM wildlife policy, the purpose of which is to provide guidance to the agency in the conservation of the species, habitat and ecosystems found on BLM lands. In order to be consistent with agency policy, the WWECs should conserve habitat and wildlife and result in overall conservation benefits to BLM Special Status Species.[9] Establishing measurable wildlife and habitat standards will increase public support for the designations and enable the agency to evaluate the effectiveness of conservation and mitigation measures. BLM wildlife policies should be applied to the Corridor Review.

BLM Special Status Species policy, found in Manual 6480, has two broad objectives: to conserve and recover ESA-listed species and their ecosystems; and to proactively reduce or eliminate threats to Bureau sensitive species in order to minimize the likelihood and need of listing these species under the ESA. To achieve overall benefits for Special Status Species, the agency should be able to demonstrate, through programmatic, corridor and project analysis and monitoring, that the designation of WWECs contributes to the recovery of listed species and improves the conservation status of Bureau sensitive species. Risks to Special Status Species must be evaluated and quantified at appropriate spatial, biological, and temporal scales.[10]

Manual 6500 establishes BLM wildlife policy "to manage habitat with emphasis on ecosystems to ensure self-sustaining populations and a natural abundance and diversity of wildlife, fish and plant resources on the public lands." Policy objectives call for the agency to "restore, maintain, and improve wildlife habitat conditions" on BLM lands, and to "increase the amount and quality of habitat available." (emphasis added). Wildlife policy is also found within the BLM's Rangeland Health Standards. Agency regulations at 43 CFR, Subpart 4180 state that "[h]abitats are, or are making significant progress towards being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species."

In addition to BLM policy, under section 7(a)(1) of the ESA, BLM is explicitly obligated to utilize its existing authorities to affirmatively conserve ESA listed species. Section 7(a)(1) is designed to ensure that federal agencies "conserve" listed species, which means to improve the status of a species to the point where it no longer requires the ESA's protection. In order to fulfill obligations under section 7(a)(1), the agencies should consider and as best practicable avoid impacts to

[9] These are species which are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those listed by a State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each State Director as sensitive. BLM Manual 6840.01

[10] Analysis at the population level is consistent with BLM policy. For example, the 6840 manual calls for determining the "population condition" of sensitive species, and monitoring "populations and habitats" to determine whether conservation objectives are being met.

geographic areas for recovery units for threatened and endangered species. BLM policy requires developers to implement mitigation measures for impacted species.

Finally, in addition to ESA section 7(a)(1), the agencies are required to consult with the USFWS under section 7(a)(2) to ensure that their actions are not likely to jeopardize listed species or result in the adverse modification of their designated critical habitat. While consultations have historically focused on the jeopardy standard, FWS has recently proposed redefining "destruction or adverse modification"[11] to focus more on recovery, in line with recommendations from the National Academy of Sciences and the majority of court decisions on this issue.[12] We expect that adverse modification and critical habitat will have more protective interpretations in the near future, and urge the agencies to consider the current rulemakings[13] in assessing potential impacts of WWEC corridor designation on critical habitat.

We believe the aforementioned BLM wildlife policy and ESA obligations provide clear guidance for the BLM's conservation objectives in the designation of WWECs and the Corridor Review. Agency wildlife policy should be used to analyze and develop a set of corridors which will:

- Conserve and help recover ESA-proposed and listed species as well as candidate and other Special Status Species;
- Reduce or eliminate threats to BLM sensitive species and minimize the likelihood of listing these species under the ESA; and
- Ensure viable (i.e., self-sustaining) populations and a natural abundance and diversity of wildlife, fish, and plant resources on the public lands.

These goals are achievable through smart planning and design without slowing the development of transmission lines or other energy development on public lands. In fact, careful planning that directs development away from the most important and sensitive places for wildlife and clarifies mitigation objectives will create greater certainty for developers and conservationists by providing clarity on what wildlife management standards must be met and what mitigation measures must be implemented to achieve these outcomes. We believe that BLM should apply this standard to corridor and project specific decision making. For example, where sensitive, threatened, and endangered species are present, BLM should demonstrate that development in designated corridors, coupled with necessary mitigation measures, achieves an overall conservation benefit.

With these specific goals in place for BLM Special Status Species, remaining impacts on individual species should be minimized and then offset through compensatory mitigation that creates benefits for wildlife in other appropriate locations.

To focus review and identify risks, the agencies must first identify where those threatened, endangered, and imperiled species are likely to be found. To assess potential risks and impacts on threatened and endangered species, we chose two analytical lenses: legal critical habitat designations and overlaps with ranges of imperiled and listed species. For **critical habitat**, we calculated the shortest distance (in meters) to all species' critical habitats within 2 km of each WWEC segment. We assigned a score from 0-10 to each WWEC segment based on the underlying **concentrations of imperiled species ranges**, measured at the watershed scale.

Recommendation: The agencies should conduct pre-consultation at the programmatic scale with the USFWS, following precedent set by the BLM for the Solar Programmatic Environmental Impact Statement. Programmatic consultation should include the scope of potential impacts both from the perspective of the jeopardy standard **and** the adverse modification of critical habitat standard, including its upcoming potential modifications.

[11] Proposed Rule, Interagency Cooperation-Endangered Species Act of 1973, as Amended, Definition of Destruction or Adverse Modification of Critical Habitat, http://federalregister.gov/a/2014-10503. Published 5/12/2014.
[12] National Research Council. *Science and the Endangered Species Act*. Washington, DC: The National Academies Press, 1995.
[13] In addition to footnote 11, see: Announcement of Draft Policy and Solicitation of Public Comment, Policy Regarding Implementation of Section 4(b)(2) of the Endangered Species Act, https://federalregister.gov/a/2014-10502; and Proposed Rule, Listing Endangered and Threatened Species and Designating Critical Habitat, Implementing Changes to the Regulations for Designating Critical Habitat, http://federalregister.gov/a/2014-10504. Both published 5/12/2014.

Recommendation: The agencies should identify any recovery units for threatened and endangered species and avoid impacting them to an extent that impedes recovery progress.

Recommendation: Where our analysis' scores for Imperiled Species risk is "Very High" (top priority) and "High," consult closely with state fish and game agencies and the US Fish and Wildlife Service to ensure that valuable wildlife resources are protected. Use the full mitigation hierarchy of avoid, minimize, and only then compensate for unavoidable impacts. In conjunction with state wildlife agencies, consider revision of corridor route or requirement of locally-specific best management practices (BMPs) to minimize impacts.

Species-Specific Wildlife Risk Analyses

In addition to the coarse-scale, West-Wide analysis, we conducted a detailed summary of several species-specific conflicts defined for each WWEC based on more granular criteria than the synthesis risk assessment products above. These summaries are not intended to be an exhaustive list of potential conflict, but to provide BLM a basis to focus additional research and fieldwork. As with the coarse-scale analyses described above, full quantitative results for the following species-specific analyses can be found in the results table at the end of this section. Maps are interspersed throughout the following pages, and corridor-specific recommendations can be found in Appendix A.

Desert tortoise

Both Mojave and Sonoran Desert Tortoise are iconic species of the desert Southwest, and the focus of extensive conservation investment and planning over the past several decades. What was then called the Mojave population of the desert tortoise was federally listed as threatened in 1990, and in 2010 the FWS found that a listing of the Sonoran population as endangered or threatened was warranted but precluded and added the population to the candidate list.[14] In 2011, taxonomists distinguished the two populations as separate species.[15] Both species are threatened by loss and fragmentation of habitat due to human development, and are expected to encounter pressure from increased heat and drought driven by climate change. Desert Tortoise will need intact corridors to migrate across the landscape and maintain genetic connectivity in the face of these threats. We mapped the intersections of WWEC segments with Mojave Desert Tortoise Conservation Areas and Priority 1 and 2 connectivity areas (as designated by the FWS), as well as intersections with important habitat for the Sonoran Desert Tortoise (BLM AZ tortoise management units Categories I and II). The FWS recommended that P1 & P2 lands be excluded from "variance" lands available for case-by-case applications from solar energy project developers, and we extend that recommendation to transmission and other forms of linear infrastructure, below.

Recommendations for Mojave Desert Tortoise:

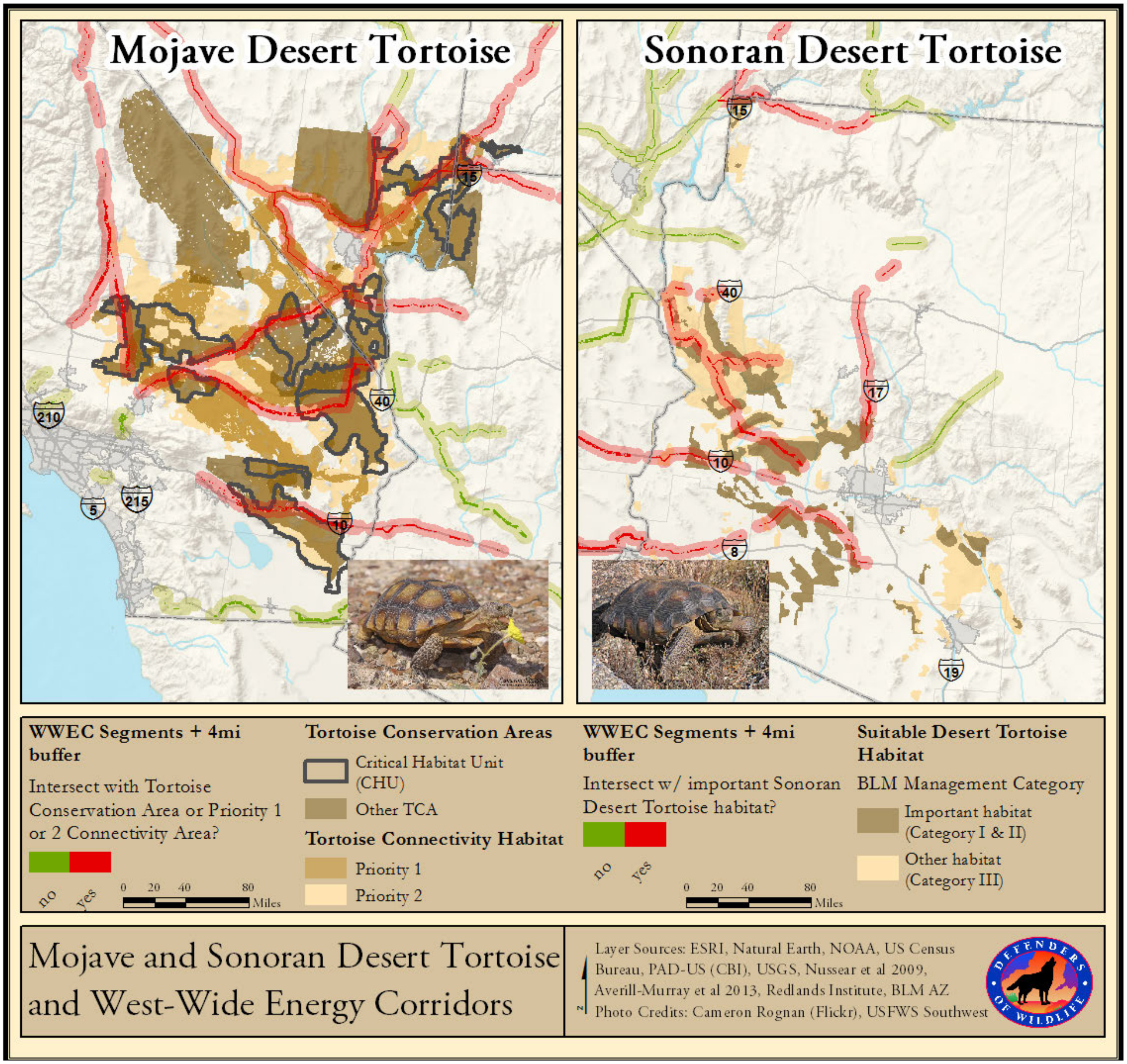
- In WWEC sections without existing transmission:
  1) Avoid siting new transmission facilities in sections that intersect Tortoise Conservation Areas, especially TCAs that are managed specifically for tortoise conservation such as Desert Wildlife Management Areas, Critical Habitat and Tortoise ACECs;
  2) Minimize disturbance and impacts to habitat and desert tortoise through effective conservation measures and minimization of ground and vegetation disturbance in priority linkage areas (P1 and P2).
- In WWEC sections with existing transmission: minimize additional transmission siting in TCAs and priority linkage areas (P1 and P2) and if additional transmission is added, site as close together as possible and with as little ground disturbance and vegetation clearing as possible.
- We also recommend careful consideration to avoid, minimize, and mitigate impacts, whether through re-routing or undergrounding wires or limiting new construction to upgrades only, within four miles of important (TCAs and priority 1 & 2 linkage areas) habitats to reduce the impact of increased corvid predation.

[14] Documents related to FWS decision-making on the species can be found at http://www.fws.gov/southwest/es/arizona/Sonoran_Tort.htm.

[15] Averill-Murray, R.C. 2011. Comment on the conservation status of the desert tortoise(s). Herpetological Review 42:500-501. Available at http://www.fws.gov/nevada/desert_tortoise/documents/publications/Averill-Murray.2011.Comment-conserv-status.pdf.

Recommendations for Sonoran Desert Tortoise:

- BLM's Rangewide Plan for Desert Tortoise Management on Public Lands established a policy of "where practicable, allow no net loss in quantity or quality of important [Category I and II] desert tortoise habitats."[16] We therefore recommend that the agencies avoid these areas, and document the decision-making process where avoidance was not practicable. Avoidance and minimization may include re-routing or undergrounding wires or limiting new construction to upgrades only, and any unavoidable impacts must be compensated for in line with existing policy and guidance.[17]
- We also recommend careful consideration to avoid, minimize, and mitigate impacts, whether through re-routing or undergrounding wires or limiting new construction to upgrades only, within four miles of important (Category I and II) habitats to reduce the impact of increased corvid predation.



[16]Management policy as quoted in AZ BLM (2012), "Desert Tortoise Mitigation Policy." Available at http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/efoia/2012IM_IB.Par.65054.File.dat/IMAZ-2012-031.pdf. The original management goals are articulated in Spang, E.F., G.W. Lamb, F. Rowley, W.H. Radtkey, R.R. Olendorff, E.A. Dahlem, and S. Slone (1988). Desert tortoise habitat management on the public lands: A rangewide plan. Report prepared for Bureau of Land Management, Division of Wildlife and Fisheries, 903 Premier Building, l8th and C Streets, N. W., Washington, D.C. 20240. 23 pp.
[17] ibid.

Mohave Ground Squirrel

Mohave ground squirrel are endemic to the Western Mojave desert in California. The species has been listed as threatened under the California Endangered Species Act since 1998. The primary cause of the decline of the Mohave ground squirrel is the destruction of its habitat due to urban, agriculture, military or energy development. Conversion of habitat leads to isolation of populations and decreases gene flow between populations which in turn decreases the resiliency of the species as a whole. Only 9% of suitable habitat in the species historic range exists in a protected state. Thus, protection of intact and connected native habitat patches is required for the long-term survival of Mohave ground squirrel. Transmission lines that intersect the remaining intact patches of native habitat further fragment and isolate populations, and lead to increased illegal off-highway vehicles use of habitat patches. We mapped whether or not WWEC segments intersect Mohave Ground Squirrel habitat, as shown in the section below on Regions of Focus.

Recommendation: Limit loss of habitat and effects on MGS through effective conservation measures and when applicable through mitigation and compensation. In modeled MGS habitat, limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas. Avoid impacts to these parcels. Within MGS habitat, the area of disturbance shall be minimized and clearing of vegetation and grading shall be avoided where possible.

Greater Sage-grouse

Greater sage-grouse are currently the focus of extensive, range-wide conservation efforts ahead of an expected listing decision by the Fish and Wildlife Service in 2015. They are also a sensitive indicator and umbrella species for the stage-steppe ecosystem of the high desert, with extensive habitat needs and a low tolerance for disturbance, including from tall structures intruding on their normally treeless landscape.[18] In developing conservation strategies for the species, many states identified "core" areas designed to protect a minimum of 75% of the population. We mapped these important habitat areas, which encompass at least 75% of the population across the range, and determined where WWEC segments intersected these areas.[19]

In developing its recommendations for avoiding listing of the Greater sage-grouse, the Conservation Objectives Team (COT) convened by the Fish and Wildlife Service used state core areas and other conservation designations to "identify the most important areas needed for maintaining sage-grouse representation, redundancy, and resilience across the landscape."[20] The COT report refers to these areas as Priority Areas for Conservation (PACs), and contends that "maintenance of the integrity of PACs...is the essential foundation for sage-grouse conservation."[21] The COT report recommends avoidance of energy development in PACs. The BLM's Sage-grouse National Technical Team (NTT) went further, stating:

> "We believe the conservation strategy most likely to meet the objective of maintaining or increasing sage-grouse distribution and abundance is to exclude energy development and other large-scale disturbances from priority habitats."[22]

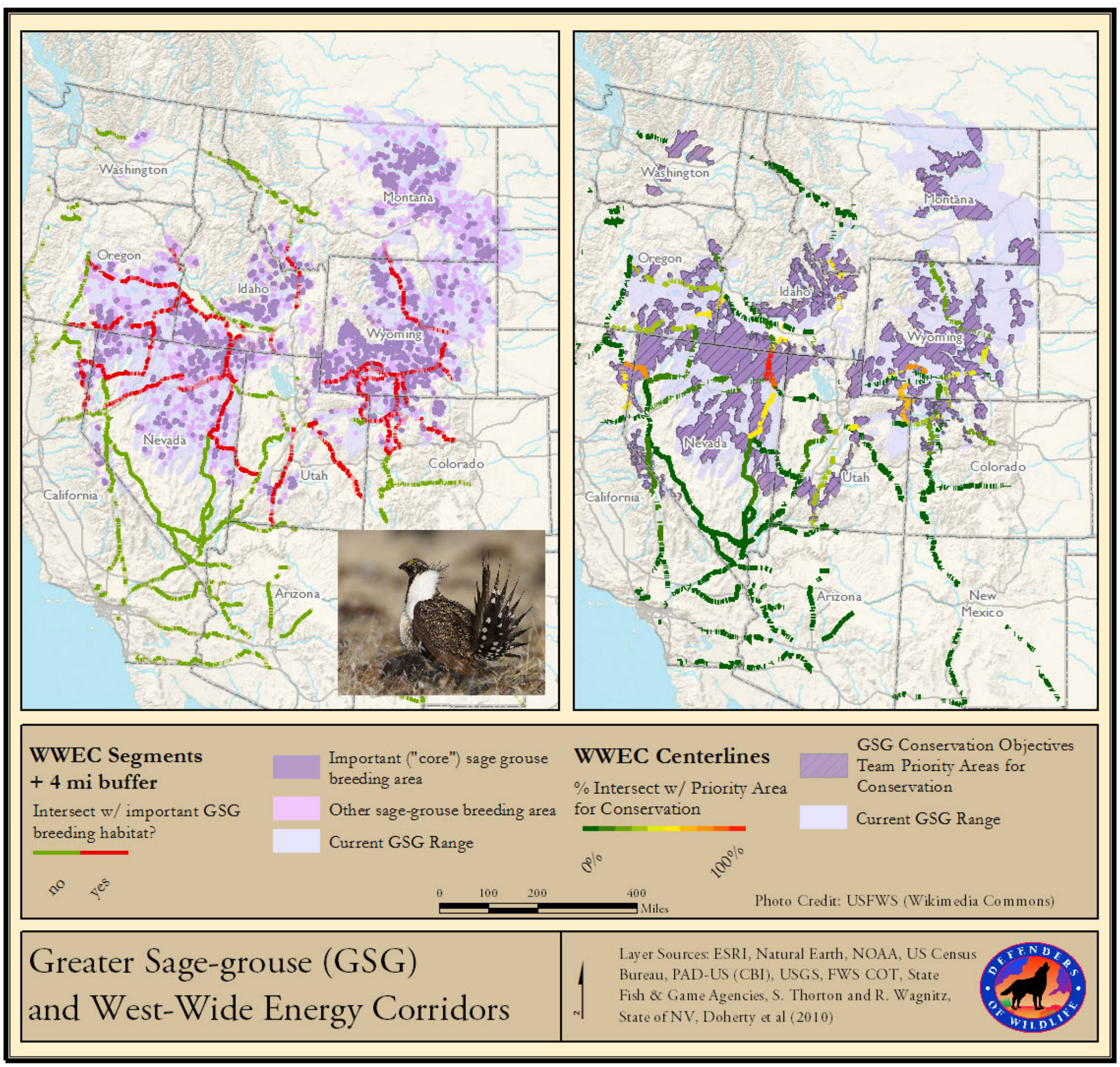
The NTT report also recommended making priority sage-grouse habitats exclusion areas for new ROWs permits, with the following possible exceptions:

[18] Bureau of Land Management Sage-grouse National Technical Team. 2011. A Report on National Greater Sage - Grouse Conservation Measures. December 21, 2011.
[19] Doherty, K. E., Tack, J. D., Evans, J. S., & Naugle, D. E. (2010). Mapping breeding densities of greater sage-grouse: a tool for range-wide conservation planning. Completion report to the Bureau of Land Management for Interagency Agreement, (L10PG00911). http://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/Documents/BLM-L10PG00911.pdf
[20] U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013. p 13.
[21] ibid., p 36.
[22] NTT Report 2011.

- "Within designated ROW corridors encumbered by existing ROW authorizations: new ROWs may be co-located only if the entire footprint of the proposed project (including construction and staging), can be completed within the existing disturbance associated with the authorized ROWs.
- Subject to valid, existing rights: where new ROWs associated with valid existing rights are required, co-locate new ROWs within existing ROWs or where it best minimizes sage-grouse impacts. Use existing roads, or realignments as described above, to access valid existing rights that are not yet developed. If valid existing rights cannot be accessed via existing roads, then build any new road constructed to the absolute minimum standard necessary, and add the surface disturbance to the total disturbance in the priority area. If that disturbance exceeds 3% for that area, then make additional effective mitigation necessary to offset the resulting loss of sage-grouse."

Finally, the NTT report recommended that the BLM "evaluate and take advantage of opportunities to remove, bury, or modify existing power lines within priority sage-grouse habitat areas."

We note that the bi-state distinct population segment (DPS) of greater-sage grouse, on the border of California and Nevada, represent a particularly vulnerable population and are proposed for listing as a threatened species in 2015. It is particularly important to avoid sensitive areas of the DPS' range and avoid, minimize, and compensate for impacts to the bi-state DPS in accordance with the NTT recommendations described above. In the case of the bi-state sage grouse, due to its isolation and declining population status, we recommend that the NTT report recommendations apply not only to "core" breeding areas but to all breeding areas. WWEC segments with potential impact to the bi-state DPS include 18-23 (which bisects a large portion of the remaining range of the bi-state DPS) and 18-224.



We mapped the overlap of each WWEC segment with PACs, as well as whether or not a WWEC segment, plus a four mile buffer to account for corvid predation,[23] intersects an important (or "core") breeding area.

Recommendation: As the PACs represent those areas defined by the states and the Fish and Wildlife Service as most important for greater sage-grouse conservation, we recommend re-routing or revising WWEC segments to exclude new infrastructure ROWs and avoid all new energy infrastructure development within PACs and within other identified "core" or "priority" areas, modified by the NTT Report's recommendations regarding existing ROWs as described above. WWEC segments that intersect with these areas should be revised to avoid them, or else should contain stipulations for limiting permitting to upgrades within the footprint of already authorized ROWs only.

Recommendation: We also recommend careful consideration to avoid, minimize, and mitigate impacts, whether through re-routing or undergrounding wires or limiting new construction to upgrades only, within four miles of PACs and other important "core" or "priority" habitats to reduce the impact of increased corvid predation.

Gunnison sage grouse

Gunnison sage-grouse number fewer than 5,000 individuals and have been reduced to eight isolated populations in southwestern Colorado and southeastern Utah. The species has been proposed for listing under the Endangered Species Act, and the same management and conservation recommendations apply to the Gunnison grouse as recommended above for Greater sage-grouse.

Colorado Parks and Wildlife defines "production areas" as a four-mile buffered area around known Gunnison sage-grouse leks, which accounts for the majority of nest sites associated with each lek, clipped to the species' range. We mapped the intersection of WWECs with Gunnison sage-grouse production areas (plus a four-mile buffer to account for increased corvid predation), as shown on the accompanying map. Note that WWECs 136-277 and 87-277 (running East-West in the map at right) cut through the most important remaining Gunnison sage-grouse habitat in the Gunnison basin.

Recommendation: Similar to our recommendations for greater sage-grouse, we recommend re-routing or revising WWEC segments to exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison sage-grouse production areas, modified by the NTT report's recommendations regarding existing ROWs as described above. WWEC segments that intersect with these areas should be revised to avoid them, or else should include stipulations for limiting permitting to upgrades within the footprint of already authorized ROWs only.

[23] Boarman, W., B. Heinrich. 1999. Corvus corax: Common Raven. The Birds of North America, 476: 1-32; Leu, M., Hanser, S.E., and Knick, S.T., 2008, The human footprint in the west-A large scale analysis of anthropogenic impacts: Ecological Applications, v. 18, p. 1119-1139. For more detail on corvid predation, see our detailed methodologies in Appendix B.

Recommendation: We also recommend careful consideration to avoid, minimize, and mitigate impacts, whether through re-routing or undergrounding wires or limiting new construction to upgrades only, within four miles of production areas to reduce the impact of increased corvid predation.

Bighorn and pronghorn

Bighorn sheep (Ovis canadensis) and pronghorn antelope (Antilocarpa americana) are both wide-ranging, iconic Western species that require large tracts of connected, undisturbed habitats. We chose these two species as indicators to examine the connectivity across the landscape, and to demonstrate the importance of avoiding, minimizing, and mitigating risk from long linear developments such as transmission and pipelines that may block migration pathways.

Bighorn[24] range regionally from summering to wintering grounds, and are sensitive to disturbance on the landscape. Hunting, competition and disease from grazing animals, and habitat encroachment diminished the population nearly to extinction in the early 1900s. A concerted conservation and reintroduction effort across the West has led to the return of Bighorn numbers, but in order to continue its recovery the species needs access to suitable habitat blocks that males and family groups can expand and spread to as their numbers increase, as well as to maintain genetic connectivity.

Pronghorn[25] are a valuable game species that is the fastest land mammal in North America. However, they live in sensitive landscapes and do not jump, making them particularly vulnerable to disturbance along their long (100+ miles) migration paths. Today's population has been reduced by 95% since the 1800s, and pronghorn continue to lose habitat due to fragmentation and human development.

As both of these species are wide-ranging and their population levels fluctuate, we chose to use the Theobald et al (2012) "Flowlines" dataset described above as a coarse-scale approximation of their need for landscape connectivity. In the section above on Landscape permeability and connectivity, we showed how each segment scored in terms of number and importance ("betweenness centrality") of the flowlines that it crossed. The maps above show how those flowlines span and connect key habitat blocks for both species, and Map 15 in Appendix A shows the segments scored by the number and magnitude of flowlines crossings.

Note for example the high-value flowline that connects the central Sierra Nevada, goes north and east through Nevada, and then connects to the high desert of southeast Oregon--that crucial north-south connectivity pathway connects very large blocks of suitable Bighorn sheep habitat, but is crossed in as many as eight places by WWEC segments.

To show Bighorn sheep suitable habitat, we used a habitat model developed by the USGS Gap Analysis Program.[26] For Pronghorn distribution data, we pieced together datasets available at the state and regional levels,[27] processed each layer to convert it into a shapefile as needed, and scaled the shapefiles for visualization at the West-wide scale. In the California desert only, we conducted a finer-scale analysis of WWEC segment intersects with Desert bighorn sheep core habitat.[28] A map of California Desert Bighorn Sheep is shown in the section below on Regions of Focus.

Recommendation: Prioritize maintaining connectivity for these wide-ranging species. Where available, follow locally-specific connectivity recommendations such as those for the Southern California Wildlands Linkages, Arizona Missing Linkages, Yellowstone to Yukon and Crown of the Continent Initiatives, and other efforts. Avoid impacts to linkages deemed of high importance in these initiatives and follow recommendations to minimize impacts (such as by bundling several corridors together to reduce proliferating right-of-ways across the landscape, and by incorporating wildlife-friendly crossing structures).

Regions of focus

Connectivity in the California Deserts

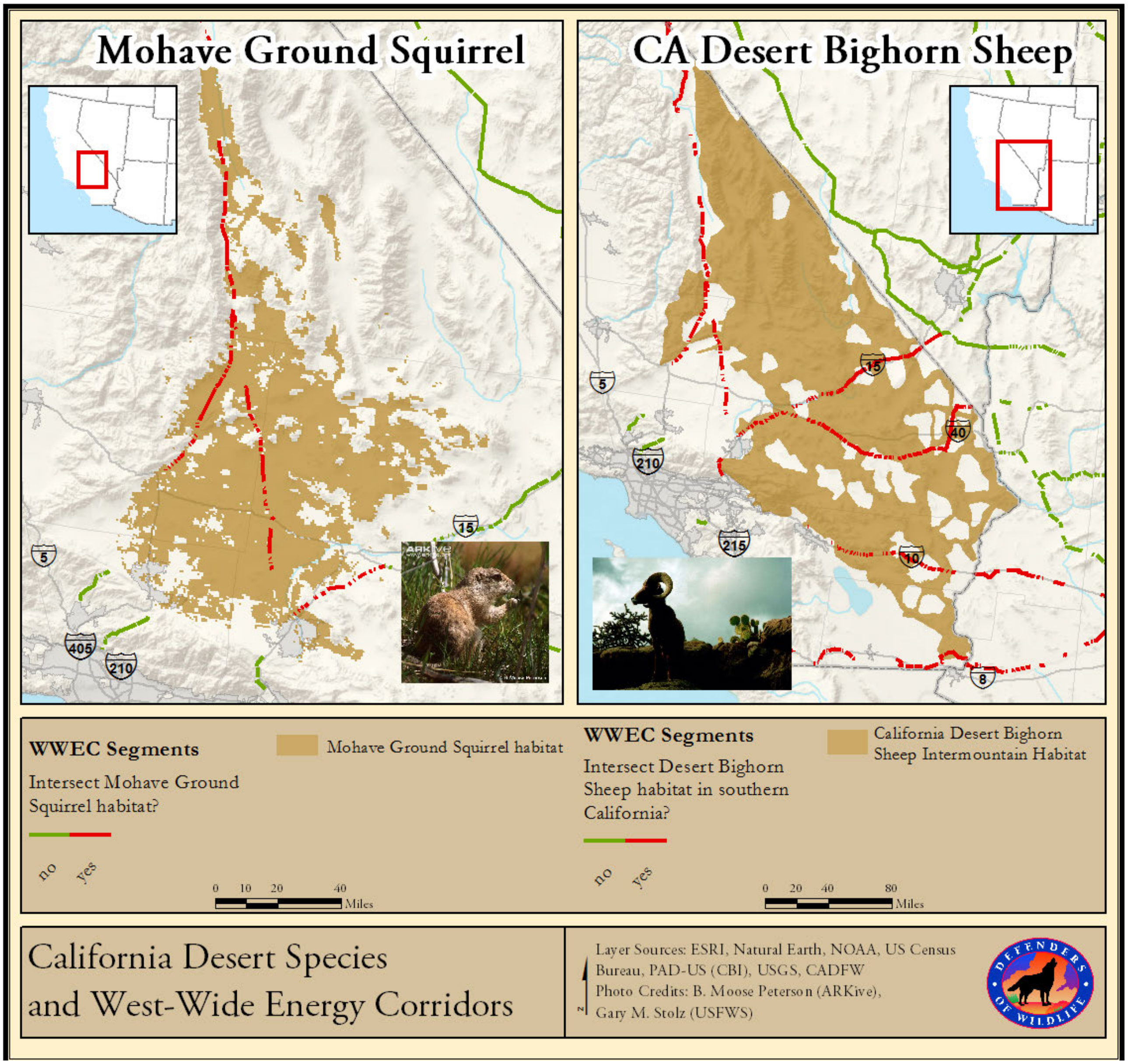
The California deserts, which includes portions of the Mojave, Sonoran/Colorado and the Great Basin ecoregions, are home to many sensitive plants and animals, many of which are endemic to the region. Additionally, the California desert is undergoing a massive planning process, the Desert Renewable Energy Conservation plan, that will define development focus areas for streamlined renewable energy permitting. Transmission is an integral part of this planning. For these reasons, we conducted focused analysis of the WWEC in the California deserts. In addition to the regional species-specific (Desert tortoise, Desert bighorn sheep, and Mohave ground squirrel) work described above, our

[24] http://www.defenders.org/bighorn-sheep/basic-facts
[25] http://www.wcs.org/saving-wildlife/hoofed-mammals/pronghorn.aspx
[26] http://gapanalysis.usgs.gov.
[27] Data sources for pronghorn distribution models include: SW Regional GAP for NV, UT, CO, NM, and AZ; Gaines, E., Kagan, J., Hak, J.C. (2000), "Oregon Land Ownership and Land Stewardship" v1. unpublished material; California Department of Fish and Wildlife, Colorado Division of Wildlife; DataBasin; Utah Division of Wildlife Resources; Wyoming Game and Fish Department; Montana Fish, Wildlife and Parks Biologists; Idaho Department of Fish and Game, and Arizona Game and Fish Department.
[28] Conservation Biology Institute (2013). Desert Bighorn Sheep - Intermountain & Unfiltered Core Habitat, DRECP. Dataset and metadata available at: http://databasin.org/datasets/18f70788685f4e7985d4a14915524cdd.

analysis included a spatial assessment of potential risks to identified wildlife connectivity corridors in developing or expanding development of transmission in the WWECs.

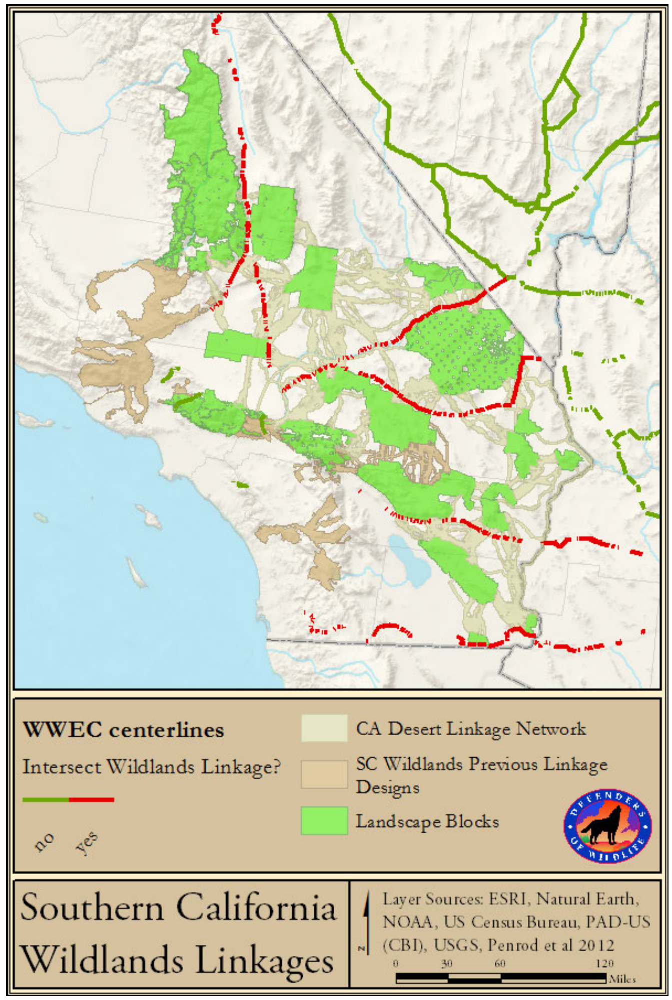
Wildlife Linkages

In addition to the analysis conducted for desert tortoise linkages described above, we conducted an analysis using the SC Wildlands "A Desert Linkage" wildlife linkage modeling (See http://www.scwildlands.org/reports/ for detailed report).[29] Long-term conservation of the California deserts will rely on maintaining connectivity across a diversity of desert ecosystems. Movement is essential to both individual and species survival and the SC Wildlands linkage design aimed to provide for the movement needs at various spatio-temporal scales: day-to-day individual movement, seasonal migrations, in response to new climatic changes, for gene flow and re-colonization of new habitat, etc. Disruption of movement patterns by development can alter ecosystem functions and isolate habitats. In order to ensure this conservation is achieved, SC Wildlands conducted a study to identify areas where maintaining or restoring ecological connectivity is essential to conserving California desert's biodiversity. To identify these linkage areas, SC Wildlands



[29] Penrod, K., P. Beier, E. Garding, and C. Cabañero. 2012. A Linkage Network for the California Deserts. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/.

modeled habitat suitability and landscape permeability, and conducted field work to validate these models and evaluate movement needs of more than 40 species at various spatio-temporal scales.



Using the SC Wildlands data, we conducted an analysis to identify sections of the WWEC that overlapped with identified wildlife linkages in the California deserts.

Recommendation: Incorporate recommendations specific to maintaining connectivity in the Southern California deserts, as described on pp 208-220 of the report "A Linkage Network for the California Deserts."[30] In particular, require best-practice crossing structures for support roads and other surface infrastructure that crosses or overlaps with a WWEC segment in this region. Where connectivity is unavoidably reduced, require compensatory mitigation by targeting investments into recommended regional connectivity and wildlife crossing improvements described in pages 220-244.

Arizona

As a member of the Arizona Solar Working Group, Defenders of Wildlife has contributed to a careful assessment of several of the West-Wide Energy Corridors at a local scale in Arizona, and we hereby incorporate the ASWG's comment letter in response to the RFI as part of this report. [31] The ASWG was assembled to promote dialogue and collaboration between conservation and wildlife organizations, renewable energy advocates, utilities, and solar developers working towards a sustainable energy future. The ASWG believes it is important to look holistically when developing generation and transmission projects to ensure that they are planned and built to avoid and minimize impacts on the state's magnificent lands and wildlife.

The agencies should use federal and state agency data, including Rapid Ecoregional Assessments, USGS research and modeling, the Arizona Game and Fish Department's (AZGFD) Heritage Data Management System, and other models and tools to develop their own predictive models that synthesize quantitative field data using an objective modeling process to estimate risk to a wide variety of Special Status Species and ecoregions from the various impacts of transmission development. AZGFD has just this year developed several state-scale models of landscape integrity and connectivity, which are not yet in public release but which the Department may be able to use to inform the BLM's Corridor Review via state consultation. The BLM should pursue this avenue to ensure that it uses the best-available science in corridor planning and decision-making.

Recommendation: Work closely with the Arizona Game and Fish Department to interpret new and evolving state- and local-scale connectivity, landscape integrity, and species distribution models to ensure full application of the mitigation hierarchy and protection of essential wildlife values.

[30] ibid.
[31] Comments Re: Recommendations Related to the Request for Information: West-wide Energy Corridor Review. Submitted May 27, 2014 by the Arizona Solar Working Group.

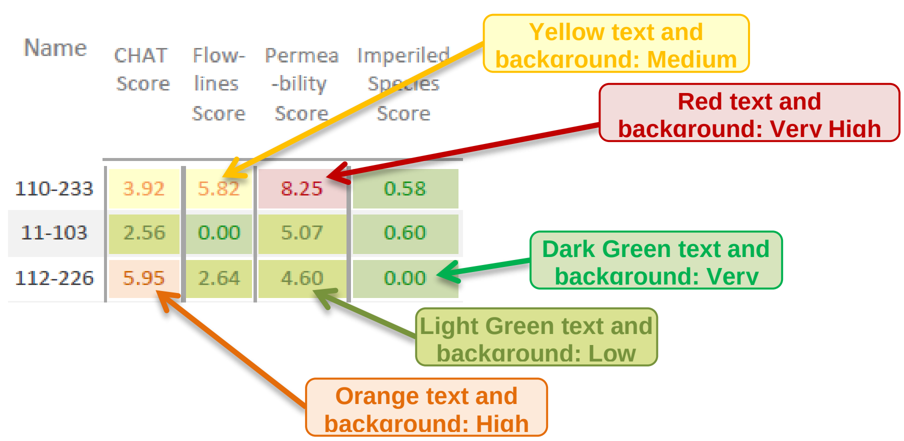
Appendix A Results and Maps

GIS Risk Analysis Results

The 4-page table that follows details our analytical results, as described above, for each WWEC segment as it was designated in the 2009 PEIS. The column names describe the following analyses:

- Flowlines Score/Rank: Score of 0-10 for potential risk to connectivity Flowlines, and Rank of Low, Medium, High, or Very High based on quartiles.
- Permeability Score/Rank: as above.
- CHAT Score/Rank: as above.
- Imperiled Species Score/Rank: as above.
- % int w GSG PACs: % of WWEC segment area that overlaps with a Priority Area for Conservation for Greater sage-grouse.
- GSG impt. breeding areas: Whether or not the WWEC segment (plus a four-mile buffer to account for corvid predation) intersects a an important (or "core") breeding area.
- GuSG production areas: Whether or not the segment (plus a four-mile buffer to account for corvid predation) intersects Gunnison sage-grouse "production areas" as identified by Colorado Parks and Wildlife.
- Sonoran DT CAT I or II: Whether or not the segment (plus a 4-mile buffer) intersects important Sonoran Desert Tortoise habitat as defined by Arizona BLM.
- TCA: Whether or not the segment (plus a 4-mile buffer) intersects a Desert Tortoise Conservation Area (TCA).
- Moj. DT Priority Connectivity: Whether or not the segment (plus a 4-mile buffer) intersects Priority 1 and/or Priority 2 connectivity habitat as defined by the USFWS.
- Desert Bighorn Sheep: Whether or not the segment intersects bighorn sheep intermountain habitat in the California Desert Renewable Energy Conservation Plan planning area.
- S. CA Wildlands Linkage: Whether or not the segment intersects a "wildlands linkage" in the California Deserts as identified by Southern California Wildlands.
- Mohave Ground Squirrel: Whether or not the segment intersects predicted occupied habitat for the Mohave Ground Squirrel.

The corridors are shown in rough order from most to least risk across the four West-wide scores, using a statistical methodology described in Appendix B. The colorations of the four West-Wide scores indicate their risk categories, determined using a Jenks algorithm as described in Appendix C.



GIS Risk Analysis Results Data Table

Name	CHAT Score	Flow-lines Score	Permea-bility Score	Imperiled Species Score	% int. w GSG PACs	GSG impt. breeding areas	GuSG produc-tion areas	Sonoran DT CAT I or II	TCA	Moj. DT Priority Connectivity	Desert Bighorn Sheep	S. CA Wild-lands Linkage	Mohave Ground Squirrel
229-254 (S)	9.44	7.43	0.00	4.29	0%								
229-254 (N)	8.08	7.43	2.99	4.46	0%								
62-211	8.51	6.67	5.13	4.16	0%								
73-133	4.05	8.60	8.51	1.82	19%	yes							
126-218	7.44	7.46	7.44	3.13	62%	yes							
66-212	3.75	9.80	7.04	2.42	2%	yes							
132-136	5.70	9.94	7.23	2.16	0%								
236-237	8.87	3.59	3.48	7.90	0%								
234-235	10.00	3.73	5.24	10.00	0%								
108-267	8.60	2.64	3.18	5.81	0%						yes		
4-247	7.78	5.36	2.80	3.61	0%								
7-24	6.48	8.61	7.34	1.29	32%	yes							
116-206	5.63	8.19	6.64	2.33	34%	yes							
46-270	2.32	8.66	7.04	2.18	0%			yes					
232-233 (E)	4.79	8.32	9.34	0.41	0%				yes	P2			
23-106	5.13	7.44	6.70	3.05	0%					P2	yes	yes	yes
261-262	7.21	6.02	2.51	3.14	0%								
10-246	7.49	3.68	3.22	4.88	0%								
107-268	7.82	0.00	2.97	3.38	0%								
18-23	3.65	7.43	7.70	2.14	14%					P2	yes	yes	yes
132-133	6.47	6.25	8.21	1.19	23%	yes							
79-216	5.32	9.95	7.07	1.72	22%	yes							
68-116	1.70	8.10	7.34	1.55	0%								
50-203	5.29	9.84	6.06	2.23	56%	yes							
27-41	3.90	7.45	8.32	0.78	0%				yes	P1/P2	yes	yes	
8-104	7.01	7.38	5.17	1.81	3%								
66-259	8.98	0.00	7.39	0.44	53%	yes							
27-225	4.24	7.45	7.53	1.06	0%				yes	P1/P2	yes	yes	
126-258	4.46	5.12	7.08	4.62	0%								
35-43	6.81	0.00	9.05	0.00	100%	yes							
138-143	7.66	5.87	4.26	2.18	31%	yes							
121-221	5.83	3.64	7.95	1.90	79%	yes							
230-248	6.71	2.67	4.05	5.44	0%								

Name	CHAT Score	Flow-lines Score	Permea-bility Score	Imperiled Species Score	% int. w GSG PACs	GSG impt. breeding areas	GuSG produc-tion areas	Sonoran DT CAT I or II	TCA	Moj. DT Priority Connectivity	Desert Bighorn Sheep	S. CA Wild-lands Linkage	Mohave Ground Squirrel
11-228	6.68	9.15	5.32	1.07	30%	yes							
264-265	7.45	4.01	3.10	7.36	0%								
224-225	3.50	2.44	8.40	3.06	0%				yes	P1/P2			
23-25	5.10	7.59	6.50	1.75	0%				yes	P1/P2	yes	yes	yes
6-15	6.21	5.72	4.29	2.66	0%								
24-228	6.03	9.11	4.11	1.44	58%	yes							
61-207	6.90	5.94	4.55	2.08	0%			yes					
51-204	5.97	2.79	2.68	3.90	0%								
5-201	8.36	6.08	2.20	1.17	0%								
101-263	6.88	4.12	2.35	3.29	0%								
15-104	5.87	6.53	5.01	1.10	52%	yes							
46-269	1.43	8.84	6.50	1.14	0%			yes					
136-277	6.56	4.34	4.97	2.01	0%		yes						
47-231	0.81	5.08	6.42	2.48	0%				yes	P1/P2			
130-131 (S)	5.70	3.84	7.21	0.58	0%								
111-226	4.84	5.39	6.75	0.48	100%	yes							
41-46	0.22	4.93	6.32	2.06	0%			yes					
43-44	5.34	5.28	8.35	0.27	84%	yes							
80-273	4.41	5.95	6.29	0.52	0%								
73-129	4.68	6.80	6.27	1.53	0%	yes							
121-220	4.06	3.59	6.19	1.86	43%	yes							
130-131 (N)	5.44	3.38	6.06	0.92	0%								
47-68	6.75	2.68	6.21	0.00	0%								
51-205	5.11	0.00	2.86	4.06	0%								
130-274	3.74	6.50	5.92	0.32	0%		yes						
55-240	4.98	4.53	3.76	3.47	0%	yes							
134-136	4.49	5.03	7.79	0.00	0%								
126-133	7.23	5.02	5.63	0.08	33%	yes							
49-202	1.27	4.99	7.03	0.42	23%	yes							
144-275	4.84	9.82	4.81	0.48	21%	yes							
16-24	2.76	9.09	5.70	0.78	12%	yes							
78-138	3.74	4.53	4.96	1.99	46%	yes							
7-8	4.72	0.00	5.17	2.34	0%								
102-105	7.72	2.46	1.15		0%								
110-114	3.55	5.74	5.89	1.36	4%	yes							

Name	CHAT Score	Flow-lines Score	Permea-bility Score	Imperiled Species Score	% int. w GSG PACs	GSG impt. breeding areas	GuSG produc-tion areas	Sonoran DT CAT I or II	TCA	Moj. DT Priority Connectivity	Desert Bighorn Sheep	S. CA Wild-lands Linkage	Mohave Ground Squirrel
110-233	3.92	5.82	8.25	0.58	14%								
11-103	2.56	0.00	5.07	0.60	0%								
112-226	5.95	2.64	4.60	0.00	53%	yes							
113-114	3.06	6.49	5.81	2.16	6%			yes	yes	P1/P2			
113-116	2.48	3.25	7.22	3.61	0%			yes	yes	P1/P2			
114-241	3.42	6.66	6.66	0.94	16%								
115-208	0.00	4.47	4.00	1.10	0%			yes					
115-238	4.37	4.17	5.65	1.81	0%			yes			yes	yes	
121-240	7.11	2.56	6.94	1.53	45%	yes							
129-218	4.64	3.57	7.01	1.87	0%	yes							
129-221	5.05	0.00	2.97	1.86	0%	yes							
130-274 (E)	4.27	7.00	8.75	0.00	0%		yes						
131-134	4.03	0.00	5.95	0.00	0%								
132-276	5.91	5.90	5.49	1.12	1%	yes							
133-142	8.78	1.96	5.50	0.92	47%	yes							
134-139	4.58	4.57	5.59	0.54	0%								
136-139	2.97	0.00	6.44	0.50	0%								
139-277	7.65	0.00	4.90	2.79	0%		yes						
15-17	2.56	5.75	6.65	0.83	0%								
16-104	4.04	6.66	7.01	0.11	73%	yes							
16-17	0.85	4.22	6.33	0.25	0%								
17-18	0.87	4.31	7.41	1.24	0%								
17-35	3.36	6.69	5.15	0.28	14%	yes							
18-224	2.80	7.42	8.17	0.93	2%					P1/P2			
218-240	5.85	0.00	4.99	2.11	7%	yes							
219-220	0.18	0.00	4.68	1.86	0%	yes							
220-221	3.69	2.58	5.11	1.54	0%	yes							
223-224	3.91	0.00	7.86	8.01	0%				yes	P1/P2			
225-231	3.18	0.00	5.84	1.09	0%				yes	P1/P2			
229-254	5.78	2.60	2.70	3.72	0%								
232-233 (W)	2.71	8.19	7.00	0.69	0%				yes	P2			
244-245	7.38	0.00	2.22		0%								
250-251	7.19	0.00	0.63	0.94	14%	yes							
256-257	7.43	0.00	3.24	0.00	0%								
27-266	4.22	1.74	7.11	1.97	0%				yes	P1/P2	yes	yes	yes

Name	CHAT Score	Flow-lines Score	Permea-bility Score	Imperiled Species Score	% int. w GSG PACs	GSG impt. breeding areas	GuSG produc-tion areas	Sonoran DT CAT I or II	TCA	Moj. DT Priority Connectivity	Desert Bighorn Sheep	So. CA Wild-lands Linkage	Mohave Ground Squirrel
29-36	1.32	7.47	5.50	0.56	0%								
30-52	3.07	3.29	4.19	1.72	0%			yes	yes	P1/P2	yes	yes	
35-111	4.88	2.98	2.96	0.76	100%	yes							
36-112	0.42	0.00	5.43	0.00	0%								
36-226	2.32	2.48	5.89	0.00	12%	yes							
36-228	0.44	7.55	5.48	0.38	0%	yes							
37-223 (N)	6.00	1.99	10.00	1.53	0%				yes	P1/P2			
37-223 (S)	2.98	0.00	7.68	1.64	0%				yes	P1/P2			
37-232	2.50	0.00	6.81	2.08	0%				yes	P1/P2			
37-39	2.97	0.00	7.34	1.18	0%				yes	P1/P2			
3-8	4.37	7.53	4.99	1.29	9%								
39-113	3.45	2.46	7.48	2.37	0%				yes	P1/P2			
39-231	2.96	0.00	5.31	2.00	0%				yes	P1/P2			
41-47	0.15	3.40	5.11	2.87	0%			yes					
43-111	7.64	3.72	9.05	0.67	100%	yes							
44-110	4.53	4.14	7.51	1.40	53%	yes							
44-239	2.19	1.65	5.42	0.32	0%								
49-112	2.00	5.05	4.85	0.00	0%								
50-51	7.81	0.00	3.27	6.64	0%								
66-209	8.08	0.00	3.73	1.71	0%								
7-11	3.97	6.78	5.07	1.11	0%								
73-138	5.51	0.00	5.58	2.29	14%	yes							
78-255	3.83	3.57	5.28	2.68	41%	yes							
78-85	3.81	0.00	4.54	2.40	0%	yes							
81-213	4.94	6.46	5.16	0.23	0%								
81-272	4.58	10.00	5.33	1.98	0%								
87-277	6.73	3.31	5.40	1.83	0%		yes						
89-271	3.67	5.70	5.08	1.05	0%								

Distance to Nearest Critical Habitats Table: within 2 km (in meters)

101-263	
Northern spotted owl	0
102-105	
Northern spotted owl	0
Marbled murrelet	0
10-246	
Northern spotted owl	0
107-268	
Southwestern willow flycatcher	1,304
Santa Ana sucker	1,315
108-267	
San Bernardino Merriam's kangaroo rat	0
Arroyo (=arroyo southwestern) toad	0
113-114	
Desert tortoise	0
113-116	
Desert tortoise	0
Southwestern willow flycatcher	0
Virgin River Chub	0
Woundfin	0
Holmgren milk-vetch	500
115-238	
Arroyo (=arroyo southwestern) toad	0
Peirson's milk-vetch	316
Quino checkerspot butterfly	632
Peninsular bighorn sheep	0
126-218	
Colorado pikeminnow (=squawfish)	0
Razorback sucker	0
126-258	
Razorback sucker	0
Colorado pikeminnow (=squawfish)	0
132-133	
Colorado pikeminnow (=squawfish)	0
132-136	
Razorback sucker	0
Colorado pikeminnow (=squawfish)	0
132-276	
Razorback sucker	0
Colorado pikeminnow (=squawfish)	0
133-142	
Colorado pikeminnow (=squawfish)	0
15-104	
Webber Ivesia	0
18-23	
Greater sage-grouse	0
Sierra Nevada bighorn sheep	0
225-231	
Desert tortoise	0
229-254	
Bull Trout	100
230-248	
Northern spotted owl	0
232-233 (E)	
Desert tortoise	0
232-233 (W)	
Desert tortoise	0
23-25	
Desert tortoise	0
234-235	
Mexican spotted owl	0
Southwestern willow flycatcher	1,273
236-237	
Arroyo (=arroyo southwestern) toad	100
Coastal California gnatcatcher	0
244-245	
Northern spotted owl	0
261-262	
Northern spotted owl	990
264-265	
California red-legged frog	400
27-225	
Desert tortoise	0
27-266	
Southwestern willow flycatcher	500
Desert tortoise	0
27-41	
Desert tortoise	0
30-52	
Coachella Valley milk-vetch	0
Coachella Valley fringe-toed lizard	0
Razorback sucker	0
Desert tortoise	0
37-223 (N)	
Desert tortoise	0
37-223 (S)	
Desert tortoise	0
37-232	
Desert tortoise	0
37-39	
Desert tortoise	0
3-8	
Northern spotted owl	0
39-113	
Desert tortoise	0
4-247	
Northern spotted owl	0
46-269	
Southwestern willow flycatcher	200
46-270	
Southwestern willow flycatcher	0
47-231	
Razorback sucker	0
Desert tortoise	0
Bonytail chub	0
6-15	
Webber Ivesia	1,100
62-211	
Southwestern willow flycatcher	1,581
Mexican spotted owl	0
66-212	
Mexican spotted owl	1,100
Razorback sucker	0
Colorado pikeminnow (=squawfish)	0
7-24	
Borax Lake chub	1,300
73-133	
Colorado pikeminnow (=squawfish)	1,300
81-272	
Southwestern willow flycatcher	600
Rio Grande silvery minnow	1,600
87-277	
Mexican spotted owl	224

Map Set

Map 1: West-Wide overview of WWECs showing Corridors of Concern

Maps 2-12: State base maps labeling all segments for reference

Map 13: CHAT scores

Map 14: Permeability scores

Map 15: Flowlines scores

Map 16: Critical Habitat

Map 17: Imperiled Species scores

WWEC Centerlines

Section 368 Corridor

Corridor of Concern

Land Management

USDA Forest Service

Bureau of Land Management

Boundaries

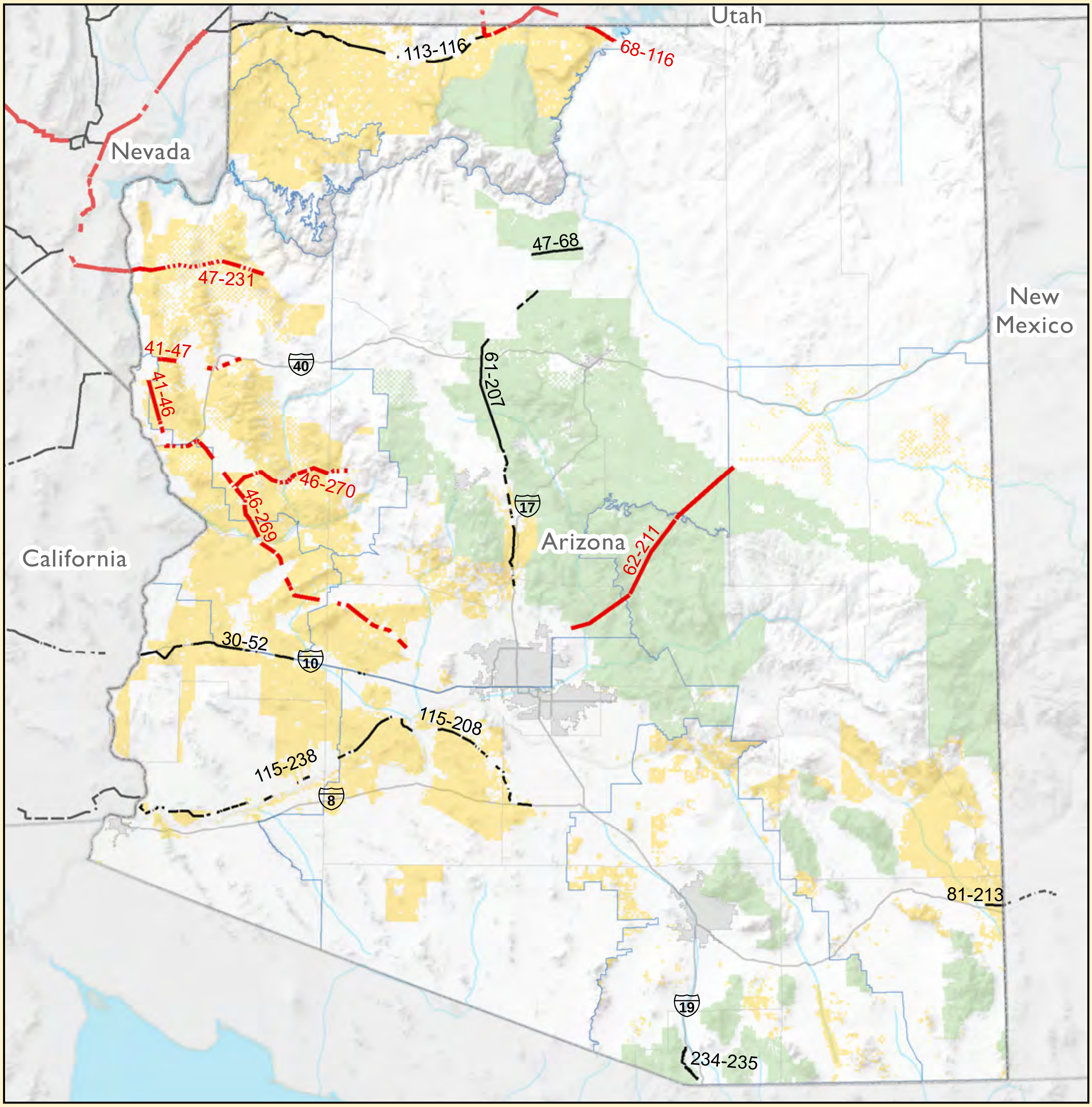
States

West Wide Energy Corridors (WWECs) Showing "Corridors of Concern"

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 50 100 200 Miles



WWEC Centerlines
- Section 368 Corridor
- Corridor of Concern

Boundaries
- States
- Counties
- BLM Administrative Units

Land Management
- USDA Forest Service
- Bureau of Land Management

Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in Arizona

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 15 30 60 Miles

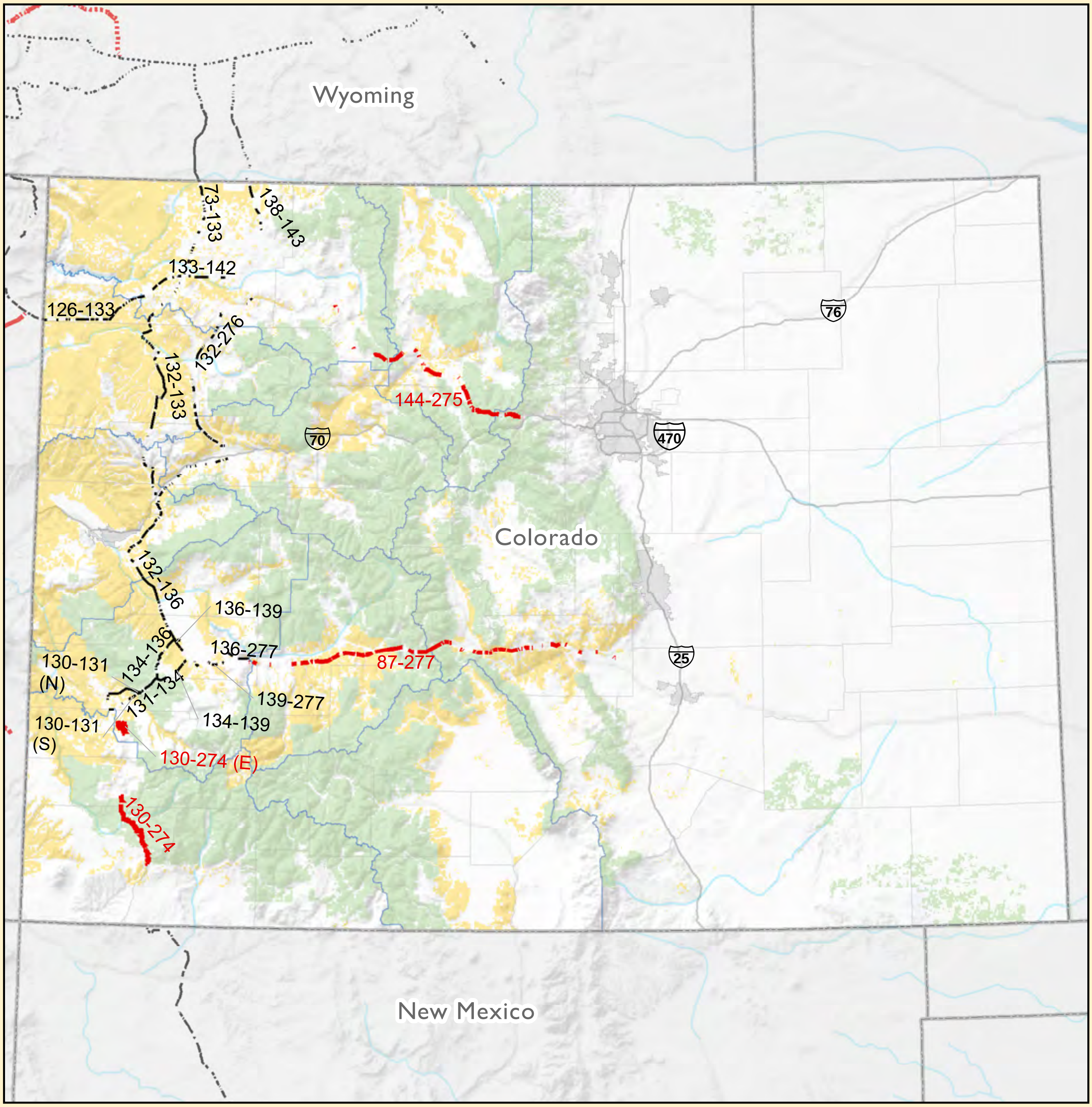
DEFENDERS OF WILDLIFE

West Wide Energy Corridors (WWECs)
Corridors in California

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

0 25 50 100 Miles

DEFENDERS OF WILDLIFE



WWEC Centerlines
- Section 368 Corridor
- Corridor of Concern

Boundaries
- States
- Counties
- BLM Administrative Units

Land Management
- USDA Forest Service
- Bureau of Land Management

Urbanized Areas

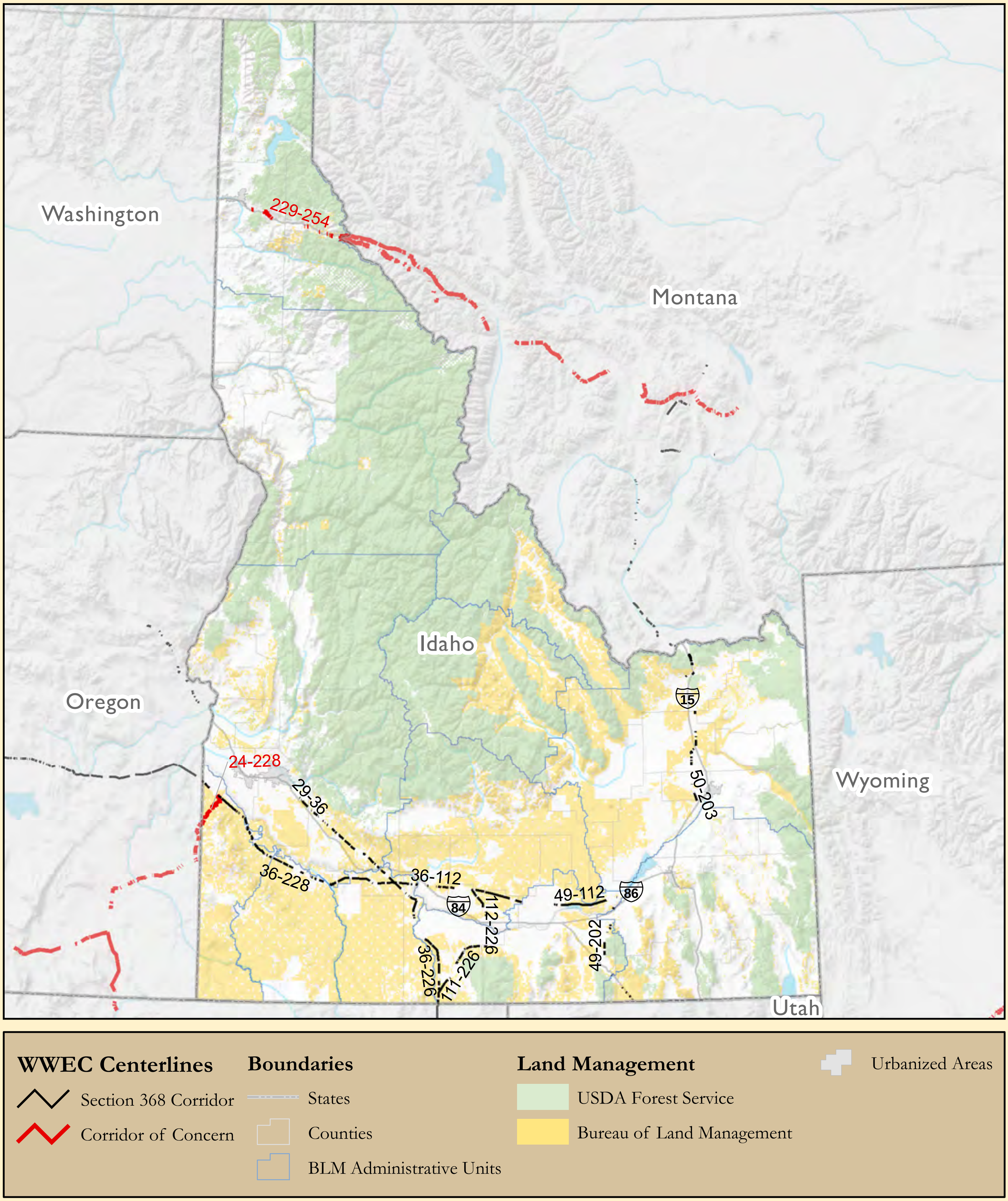
West Wide Energy Corridors (WWECs) Corridors in Colorado

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 15 30 60 Miles

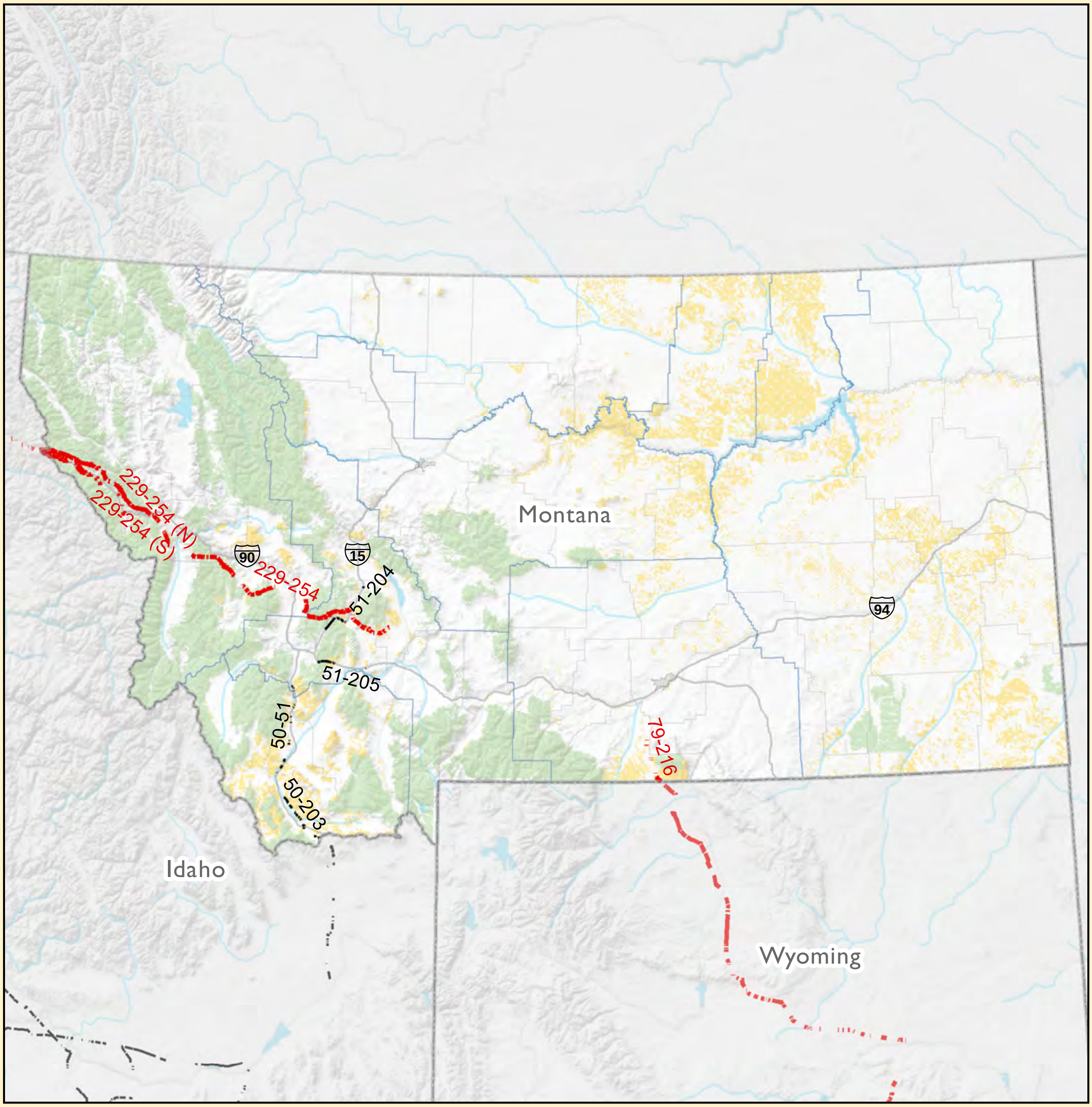
DEFENDERS OF WILDLIFE



West Wide Energy Corridors (WWECs)
Corridors in Idaho

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

0 20 40 80 Miles



WWEC Centerlines
- Section 368 Corridor
- Corridor of Concern

Boundaries
- States
- Counties
- BLM Administrative Units

Land Management
- USDA Forest Service
- Bureau of Land Management

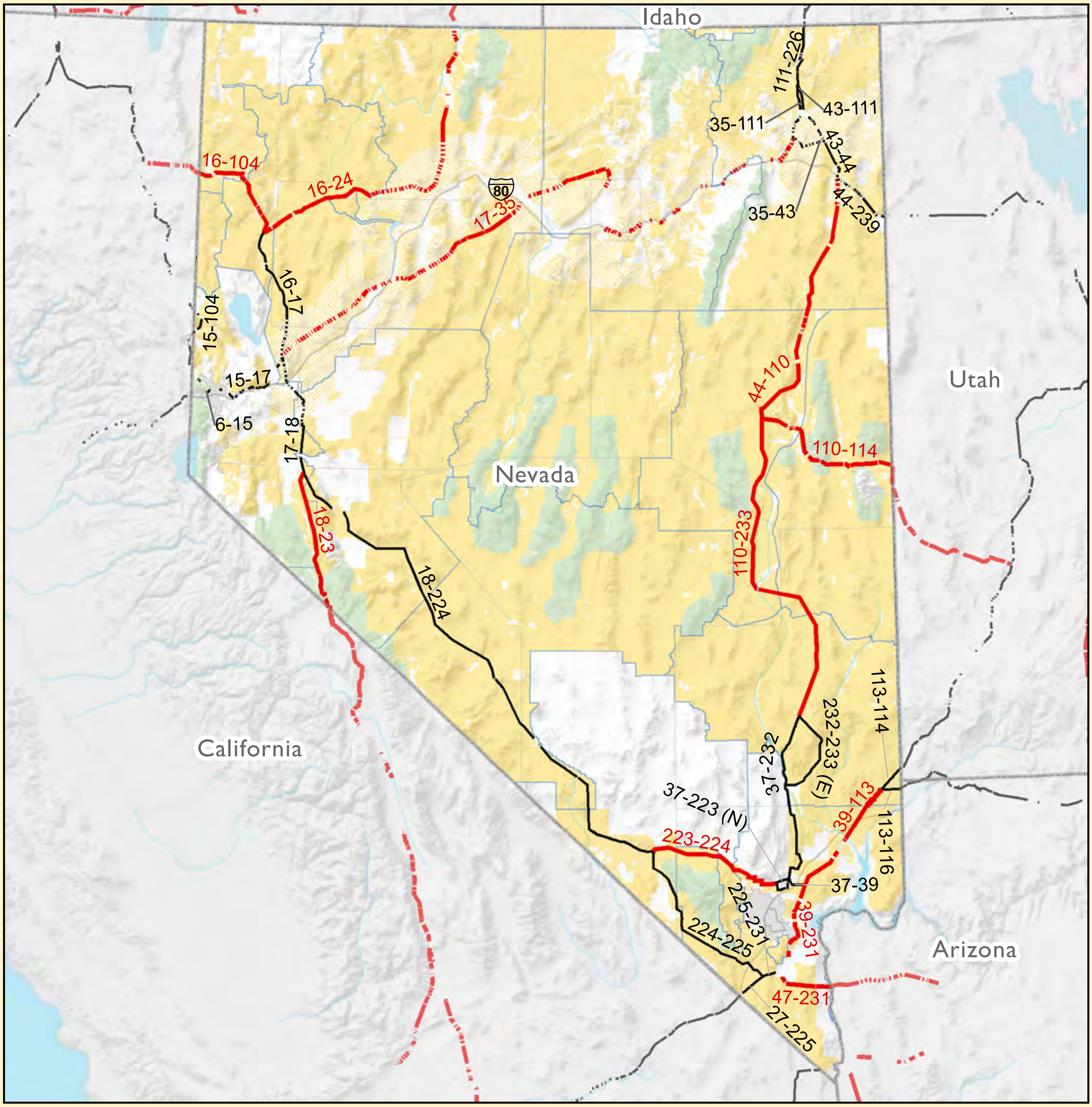
Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in Montana

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 25 50 100 Miles



WWEC Centerlines

- Section 368 Corridor
- Corridor of Concern

Boundaries

- States
- Counties
- BLM Administrative Units

Land Management

- USDA Forest Service
- Bureau of Land Management

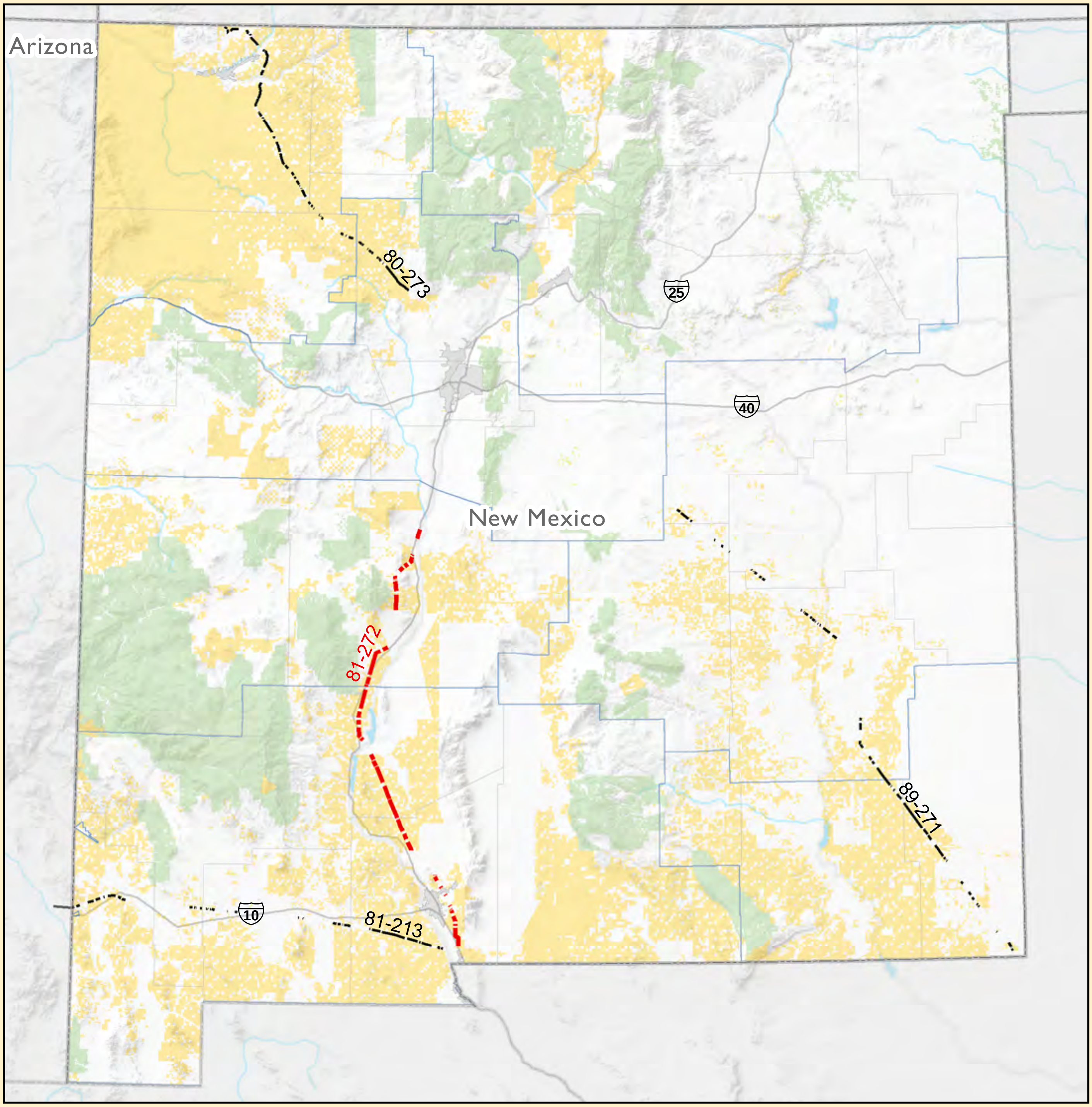
Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in Nevada

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 20 40 80 Miles



WWEC Centerlines
- Section 368 Corridor
- Corridor of Concern

Boundaries
- States
- Counties
- BLM Administrative Units

Land Management
- USDA Forest Service
- Bureau of Land Management

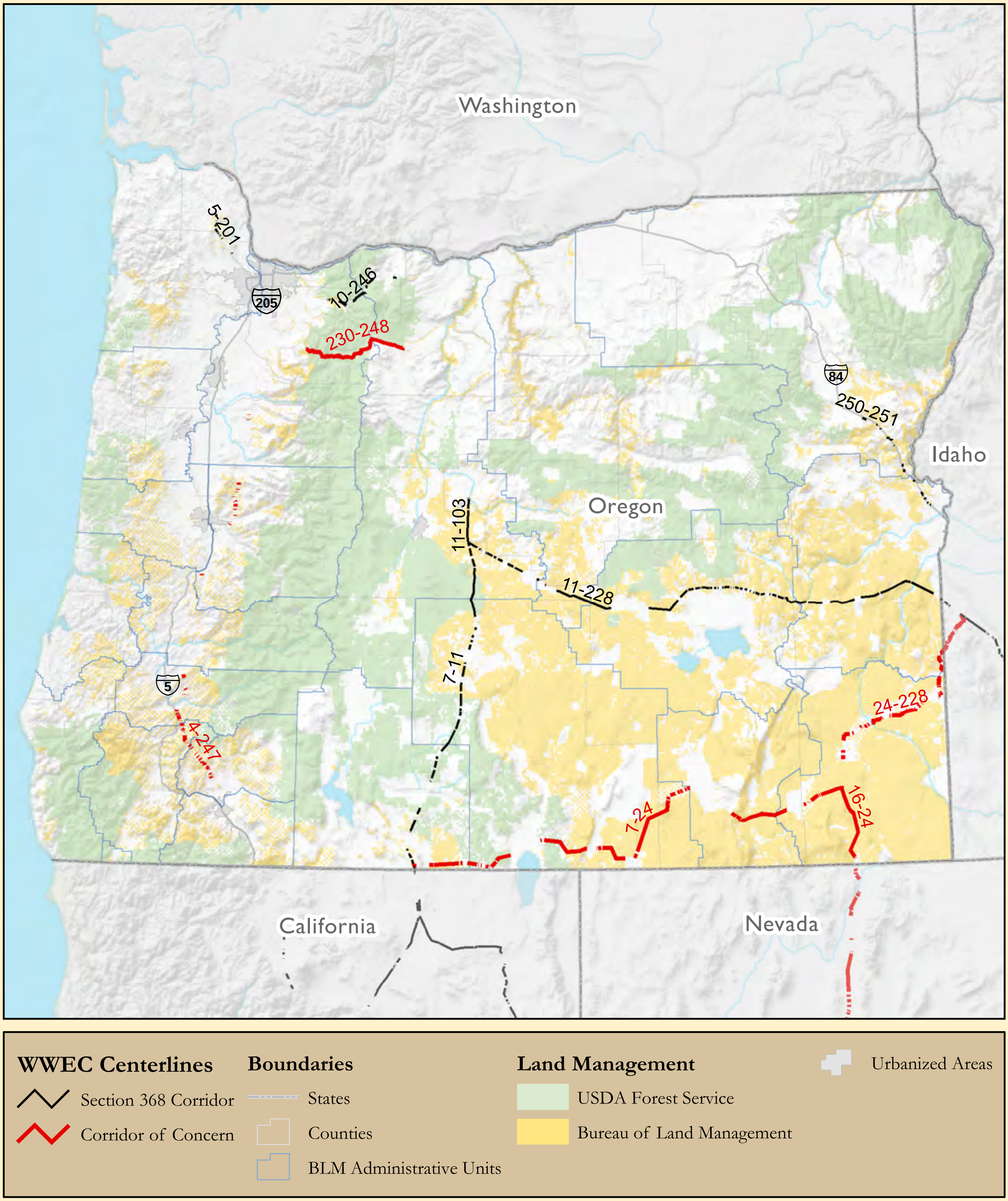
Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in New Mexico

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

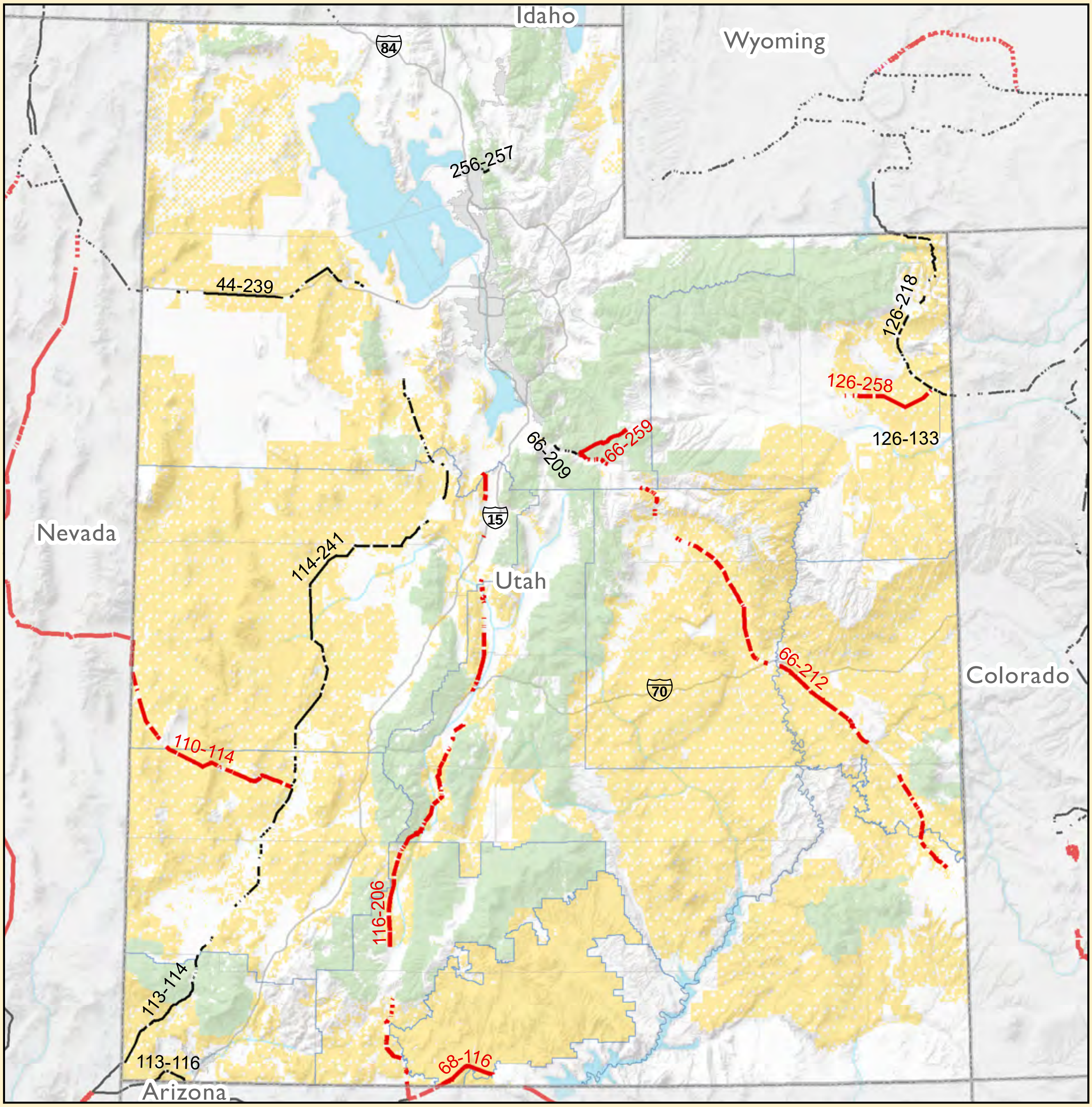
0 15 30 60 Miles



West Wide Energy Corridors (WWECs) Corridors in Oregon

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

0 15 30 60 Miles



WWEC Centerlines

Section 368 Corridor

Corridor of Concern

Boundaries

States

Counties

BLM Administrative Units

Land Management

USDA Forest Service

Bureau of Land Management

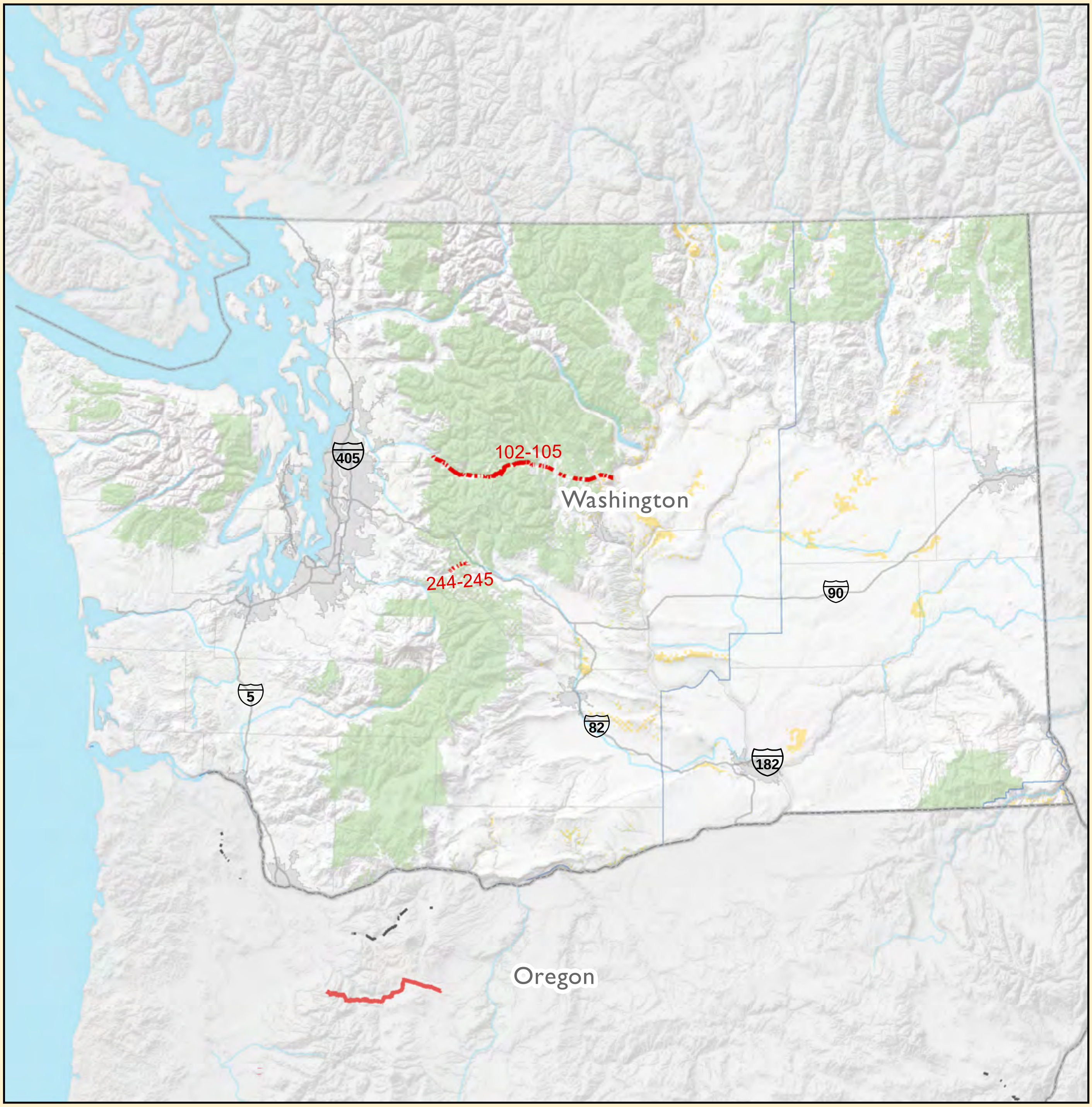
Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in Utah

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 15 30 60 Miles



WWEC Centerlines

Section 368 Corridor

Corridor of Concern

Boundaries

States

Counties

BLM Administrative Units

Land Management

USDA Forest Service

Bureau of Land Management

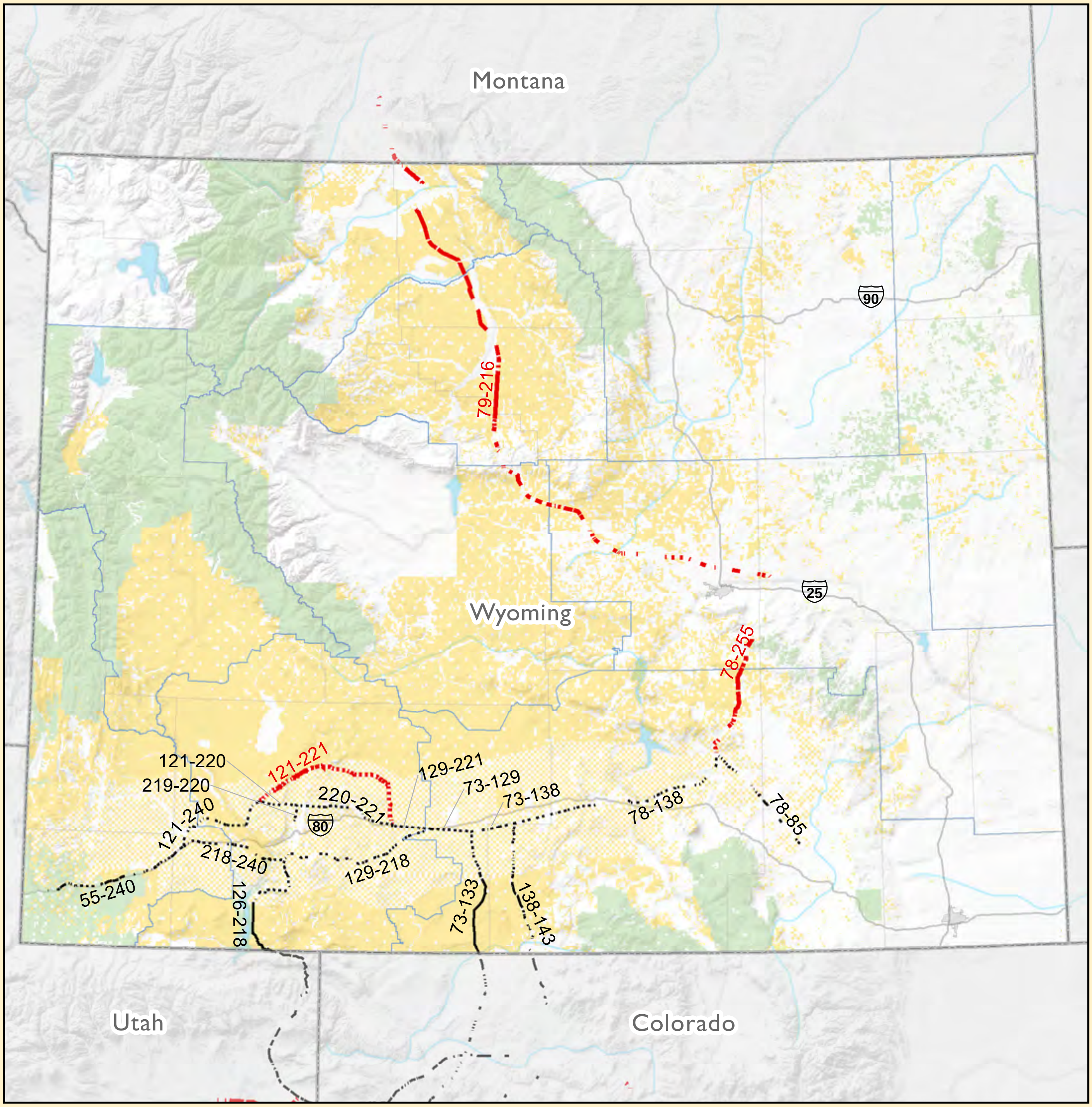
Urbanized Areas

West Wide Energy Corridors (WWECs) Corridors in Washington

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 15 30 60 Miles



WWEC Centerlines
- Section 368 Corridor
- Corridor of Concern

Boundaries
- States
- Counties
- BLM Administrative Units

Land Management
- USDA Forest Service
- Bureau of Land Management

Urbanized Areas

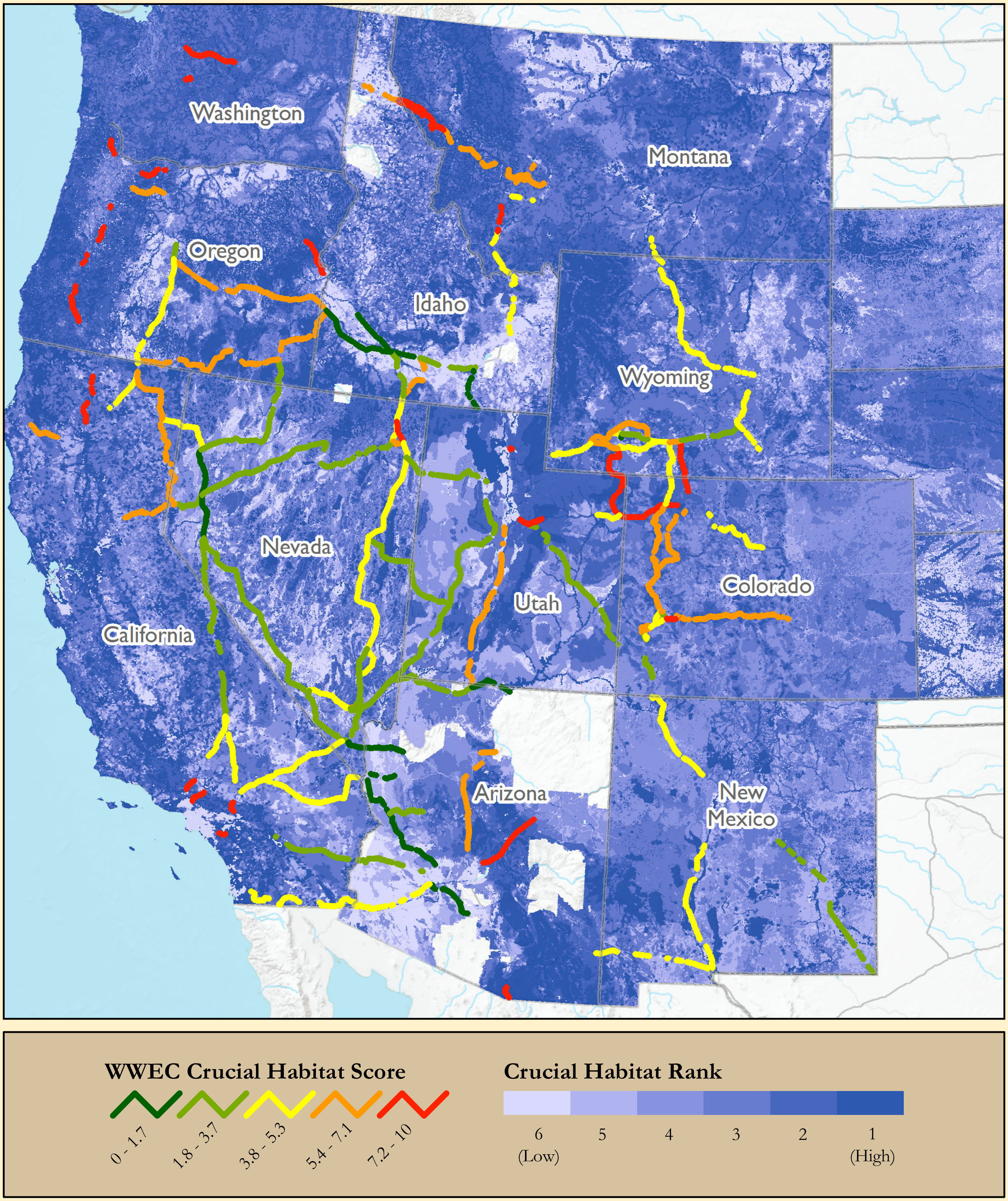
West Wide Energy Corridors (WWECs) Corridors in Wyoming

Layer Sources: BLM, USFS, ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS

N

0 15 30 60 Miles

DEFENDERS OF WILDLIFE



Crucial Habitat Assessment Risk Score

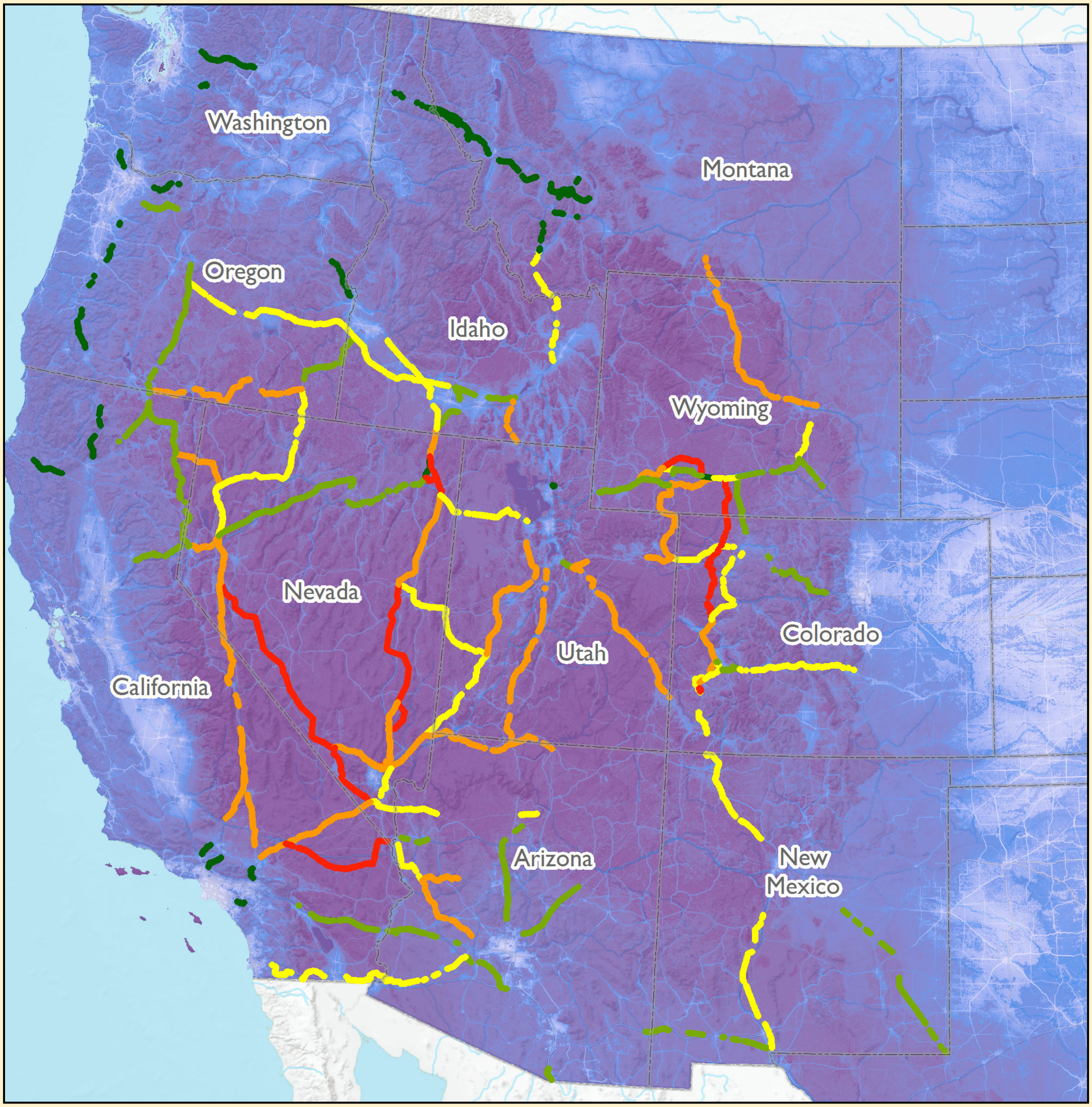
Crucial Habitat Rank (1 high - 6 low) was identified by each state under direction of the Western Governor's Association. Each segment was scored (10 high - 0 low) based on its underlying CHAT value.

Layer Sources: ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS, WGA, AZGFD, CPW, CDFW

N

0 50 100 200 Miles

DEFENDERS OF WILDLIFE



WWEC Landscape Pemeability Score

0 - 3.5
3.6 - 5.2
5.3 - 6.4
6.5 - 7.9
8 - 10

Landscape Permeability

Low High

Landscape Permeability Risk Score

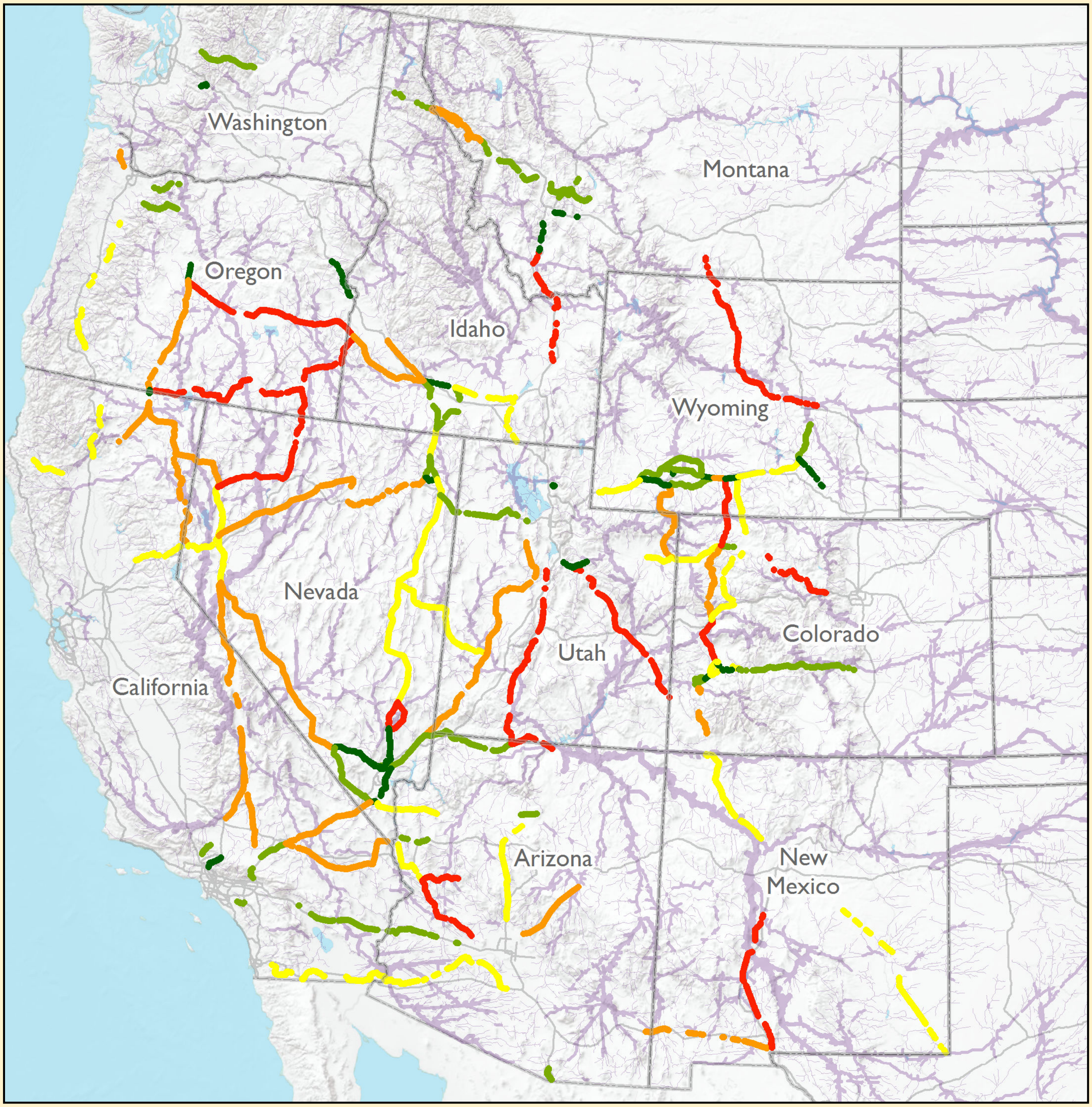
Each segment was scored (10 high - 0 low) based on the sum total, or cumulative impact, of the values of the landscape permeability modelled cells underlying the segment.

Layer Sources: ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS, NatureServe

N

0 50 100 200 Miles

DEFENDERS OF WILDLIFE



WWEC Flowlines Score

0
0.1 - 4
4.1 - 6
6.1 - 7.6
7.7 - 10

Flowlines

Betweenness Centrality

low high

Flowlines Risk Score

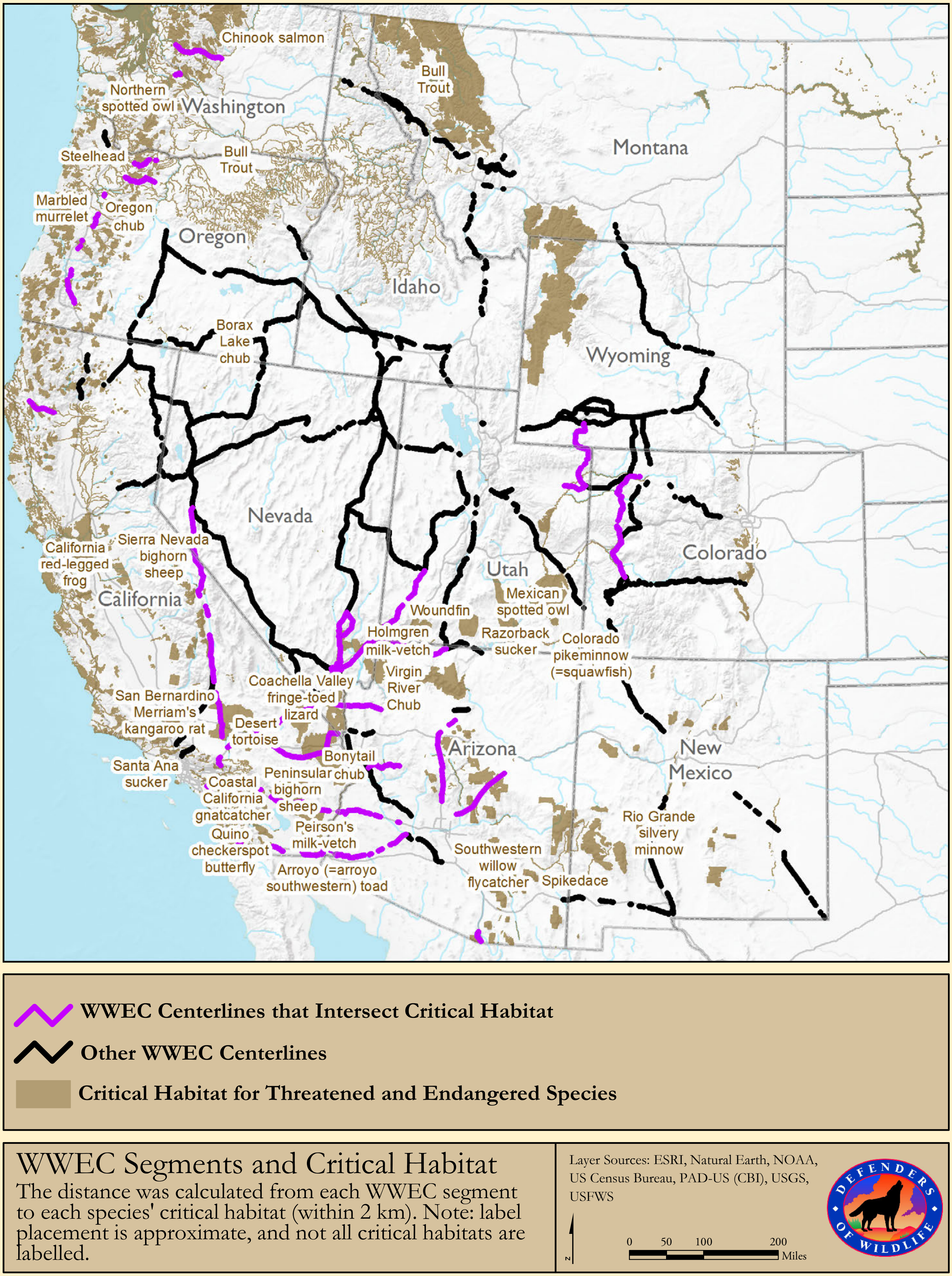
Each segment was scored (10 high - 0 low) based on a combination of the maximum value (betweenness centrality) and the total number of flowlines that it intersects.

Layer Sources: ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS, NatureServe

N

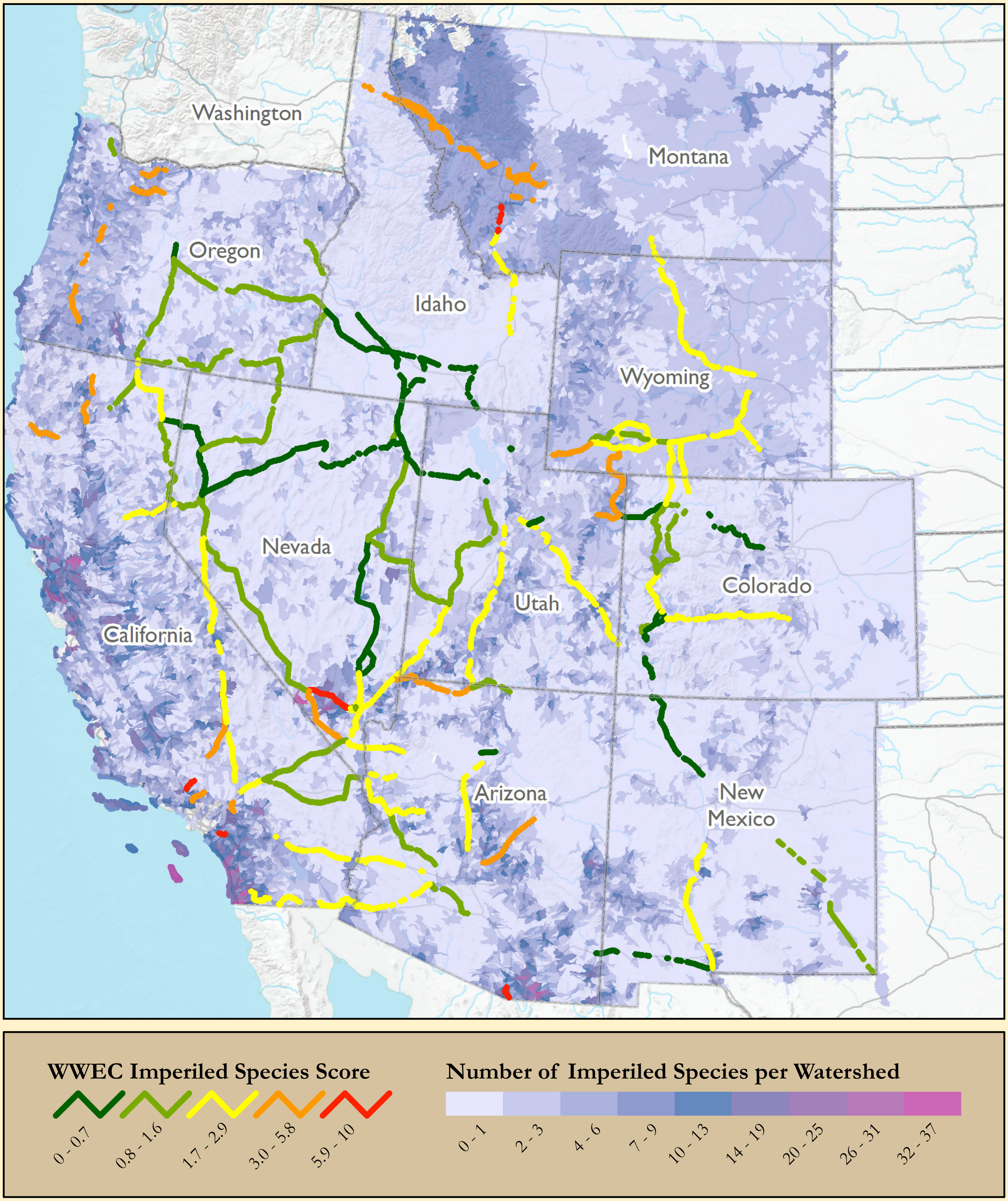
0 50 100 200 Miles

DEFENDERS OF WILDLIFE



WWEC Segments and Critical Habitat

The distance was calculated from each WWEC segment to each species' critical habitat (within 2 km). Note: label placement is approximate, and not all critical habitats are labelled.



Imperiled Species by Watersheds Risk Score

Each segment was scored (10 high - 0 low) based on the number of G-1 or G-2 ranked imperiled species, or ESA species, whose ranges are found in watersheds traversed by the segment. Data was not available for Washington.

Layer Sources: ESRI, Natural Earth, NOAA, US Census Bureau, PAD-US (CBI), USGS, NatureServe

DEFENDERS OF WILDLIFE

Appendix B Segment-specific recommendations

The table that follows lists Defenders of Wildlife's recommendations for each of the WWECs. In most cases across the West, our recommendations follow solely from the GIS analysis described in this report. As such, it is important that the agencies consider additional information when making decisions about corridor revisions, additions, deletions, etc. Our recommendations for what types of additional information the agencies should include is contained in our comment letter in response to the WWEC Request for Information, submitted on 5/27/2014.

In the California Desert, Defenders has the expertise to make more detailed, site-specific recommendations, informed by the results of our GIS risk analysis, and we have done so in that region.

Recommendations rubric

- Two "Very High" scores brings an automatic recommendation to delete and/or replace the segment entirely.
- 75% or greater overlap with GSG PACs brings an automatic recommendation to delete and replace.
- We did not provide a recommendation related to GSG PACs if the overlap was <5%. However, we reiterate that all new energy infrastructure should still be avoided in PACs.
- The recommendation given for the corridor is the most conservative available, as described above. If no recommendation is maximally conservative/overrides the others, all are given.
- While our overall recommendations include West-wide scores scoring in both the "Very High" and "High" risk categories, we prioritized "Very High" risk segments and our recommendations below therefore focus on that.
- The rubric below shows our abbreviated recommendations, described in more detail above.
- The corridors are shown in rough order from most to least risk across the four West-wide scores, using a statistical methodology described in Appendix B. The colorations (described in Appendix A) of the four West-Wide scores indicate their risk categories, determined using a Jenks algorithm as described in Appendix B.

Of concern	Re-route to avoid resources identified as "of concern."
CritHab	Consult with USFWS to avoid adverse modification to designated critical habitat.
CHAT	Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.
Perm	Reroute to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.
Flow	Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.
Imperiled	Consult closely with state fish and game agencies and the US Fish and Wildlife Service to ensure that valuable wildlife resources are protected from the "Very High" risk to Imperiled Species posed by this segment. Identify and where present avoid impacts to geographic areas for recovery units for threatened and endangered species.
Greater Sage Grouse	Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (X% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.
Gunnison SG Prod	Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.
SoDT	Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.
TCA	Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible

	and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs.
Mojave DT P1/P2	Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of P1 & P2 habitat.
Desert Bighorn Sheep	Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert.
Wildlands	This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region.
MGS	Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible.

229-254 (S)

229-254 (S)

Total Segment Length: 42.68 km

Recommendations:

Re-route to avoid resources "of concern." Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
9.44	7.43	0.00	4.29

Listed as 'Of concern' In settlement agreement. Why?:

ID: critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act.

229-254 (N)

229-254 (N)

Total Segment Length: 102.88 km

Recommendations:

Re-route to avoid resources "of concern." Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.08	7.43	2.99	4.46

Listed as 'Of concern' In settlement agreement. Why?:

ID: critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act.

62-211

62-211

Total Segment Length: 138.19 km

Recommendations:

Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to Mexican spotted owl and Southwestern willow flycathcer (within 2 km) designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.51	6.67	5.13	4.16

Listed as 'Of concern' In settlement agreement. Why?:

AZ: access to coal, impacts to citizen-proposed and designated Wilderness, National Historic Place, Wild & Scenic Rivers, Mexican spotted owl critical habitat.

73-133

73-133

Total Segment Length: 80.12 km

Recommendations:

Delete/replace this segment. This segment scores "Very High" risk for both Flowlines and Permeability. Consult with USFWS to avoid adverse modification to Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.05	8.60	8.51	1.82

126-218

126-218

Total Segment Length:	129.97 km

Recommendations:
Substantially re-route this segment and follow overall recommendations for the following West-wide risk scores: "High" risk to Flowlines, "High" risk to Permeability, "Very High" risk to CHAT, and "High" risk to Imperiled Species. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (62% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Identify and where present avoid impacts to geographic areas for recovery units for threatened and endangered species. Consult with USFWS to avoid adverse modification to designated Colorado pikeminnow and Razorback sucker critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.44	7.46	7.44	3.13

66-212

66-212

Total Segment Length:	189.38 km

Recommendations:
Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity. Consult with USFWS to avoid adverse modification to Mexican spotted owl (within 2 km), Razorback sucker, and Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.75	9.80	7.04	2.42

Listed as 'Of concern' In settlement agreement. Why?:
UT: access to coal plant, impacts to National Historic Places, America’s Byways, Old Spanish Trail, BLM Wilderness Study Area, UT-proposed Wilderness, critical habitat, adjacent to Arches National Park.

132-136

132-136

Total Segment Length:	70.81 km

Recommendations:
Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity. Consult with USFWS to avoid adverse modification to Razorback sucker and Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.70	9.94	7.23	2.16

236-237

236-237

Total Segment Length:	10.89 km

Recommendations:
Delete/replace this segment. This segment scores "Very High" risk for both CHAT and Imperiled Species. Consult with USFWS to avoid adverse modification to Arroyo southwestern toad and Coastal California gnatcatcher designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.87	3.59	3.48	7.90

234-235

234-235

Total Segment Length: 23.86 km

Recommendations:

Delete/replace this segment. This segment scores "Very High" risk for both CHAT and Imperiled Species. Consult with USFWS to avoid adverse modification to Mexican spotted owl and Southwestern willow flycatcher designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
10.00	3.73	5.24	10.00

108-267

108-267

Total Segment Length: 18.17 km

Recommendations:

While this segment scores "Very High" risk for both CHAT and Imperiled Species, it is also in major interstate highway corridor (I-15) and has existing transmission. Expansion of transmission facilities in this segment should be done in consultation with with USFWS to avoid adverse modification to San Bernardino's Merriam's kangaroo rate and Arroyo southwestern toad designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.60	2.64	3.18	5.81

4-247

4-247

Total Segment Length: 38.09 km

Recommendations:

Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to Northern spotted owl designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.78	5.36	2.80	3.61

Listed as 'Of concern' In settlement agreement. Why?:

OR: not close enough to QRA, old-growth forests, critical habitat, late-successional reserves, riparian reserves.

7-24

7-24

Total Segment Length: 222.24 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (32% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity. Consult with USFWS to avoid adverse modification to Borax lake chub designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.48	8.61	7.34	1.29

Listed as 'Of concern' In settlement agreement. Why?:

OR: 3 citizen-proposed wilderness areas, sage-grouse habitat, pygmy rabbit habitat, Steens Mountain Cooperative Management Area, and proposed Sheldon Mountain National Wildlife Refuge.

116-206 2014 Request for Information

Public Input

116-206

Total Segment Length: 186.89 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (34% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.63	8.19	6.64	2.33

Listed as 'Of concern' In settlement agreement. Why?:

UT: undisturbed, monument, Old Spanish Trail, UT-proposed Wilderness, near USFS Inventoried Roadless Area.

46-270

46-270

Total Segment Length: 59.12 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.32	8.66	7.04	2.18

Listed as 'Of concern' In settlement agreement. Why?:

AZ: Wild & Scenic river, Southwestern willow flycatcher critical habitat.

232-233 (E)

232-233 (E)

Total Segment Length: 72.89 km

Recommendations:

Delete/replace this segment. This segment scores "Very High" risk for both Flowlines and Permeability. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.79	8.32	9.34	0.41

23-106

23-106

Total Segment Length:	60.01 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of P1 & P2 habitat. Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert. Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible. This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.13	7.44	6.70	3.05

Listed as 'Of concern' In settlement agreement. Why?:

CA: National Conservation Area, Area of Critical Environmental Concern.

261-262

261-262

Total Segment Length:	30.82 km

Recommendations:

Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to Northern spotted owl designated critical habitat within 2 km.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.21	6.02	2.51	3.14

10-246

10-246

Total Segment Length:	26.14 km

Recommendations:

Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to designated Northern spotted owl critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.49	3.68	3.22	4.88

107-268

107-268

Total Segment Length: 27.84 km

Recommendations:

Re-route to avoid resources "of concern." Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to designated Southwestern willow flycatcher and Santa Ana sucker critical habitat within 2km of segment.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.82	0.00	2.97	3.38

Listed as 'Of concern' In settlement agreement. Why?:

CA: National Forest, citizen-proposed Wilderness.

18-23

18-23

Total Segment Length: 277.07 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of P1 & P2 habitat.

Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert. This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region.

Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible.

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (14% overlap), and within *all* breeding areas of the bi-state Distinct Population Seg,emt. It is essential that agencies use the full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of all bi-state sage-grouse breeding areas.

Consult with USFWS to avoid adverse modification to Greater sage-grouse (bi-state distinct population segment) and Sierra Nevada Bighorn Sheep designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.65	7.43	7.70	2.14

Listed as 'Of concern' In settlement agreement. Why?:

CA: Areas of Critical Environmental Concern, Inventoried Roadless Areas, BLM Wilderness Study Areas, CA Boxer Wilderness, CA-proposed Wilderness, NV-proposed Wilderness, sage-grouse habitat, redundant to 18-224.

132-133

132-133

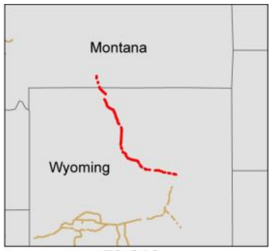
Total Segment Length: 84.75 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (23% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained. Consult with USFWS to avoid adverse modification to Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.47	6.25	8.21	1.19

79-216



79-216

Total Segment Length:	202.54 km

Recommendations:
Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (22% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.32	9.95	7.07	1.72

Listed as 'Of concern' In settlement agreement. Why?:
WY: sage-grouse core area and habitat, National Register of Historic Places properties, National Historic Trail.

68-116

68-116

Total Segment Length:	65.43 km

Recommendations:
Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
1.70	8.10	7.34	1.55

Listed as 'Of concern' In settlement agreement. Why?:
AZ: access to coal, impacts to Grand Staircase-Escalante National Monument, Wild & Scenic Rivers, scenic byway. UT: Grand Staircase National Monument, Paria River.

50-203

50-203

Total Segment Length:	65.64 km

Recommendations:
Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (56% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.29	9.84	6.06	2.23

27-41

27-41

Total Segment Length:	189.23 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat. Specifically, this corridor runs through the Piute Valley within the Piute-Fenner critical habitat unit, an area that is known for high desert tortoise density and high quality habitat. Avoid the Piute Valley be revising the corridor so that it is aligned with I-40 and does not run north and then east through critical habitat.

This corridor parallels Route 66 and is inconsistent with the BLM’s Route 66 Management Plan. Re-route so that corridor is aligned with Interstate 40 and the California BLM’s designated utility corridors per the CDCA plan.

This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.90	7.45	8.32	0.78

8-104

8-104

Total Segment Length:	112.18 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.01	7.38	5.17	1.81

66-259

66-259

Total Segment Length:	28.95 km

Recommendations:

Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (53% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.98	0.00	7.39	0.44

Listed as 'Of concern' In settlement agreement. Why?:

UT: access to coal plant, impacts to USFS Inventoried Roadless Area.

27-225

27-225

Total Segment Length:	134.86 km		

Recommendations:

This corridor intersects Tortoise Conservation Areas, including desert tortoise critical habitat and Priority 1 & 2 habitat. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat. This corridor segment intersects a wildlife linkage for the California desert. Please see general recommendations for maintaining connectivity included in this report.

Additionally, this corridor could increase transmission capacity for utility-scale renewable energy projects that are poorly sited within high quality habitat for desert tortoise and undermine the overall landscape intactness of the northern and eastern Mojave desert.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.24	7.45	7.53	1.06

126-258

126-258

Total Segment Length:	40.91 km		

Recommendations:

Re-route to ensure connection to renewable energy resources.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.46	5.12	7.08	4.62

Listed as 'Of concern' In settlement agreement. Why?:

UT: access to coal plant.

35-43

35-43

Total Segment Length:	13.56 km		

Recommendations:

Delete/replace: 100% overlap with Greater sage-grouse PACs.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.81	0.00	9.05	0.00

138-143

138-143

Total Segment Length:	50.18 km		

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (31% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.66	5.87	4.26	2.18

121-221

121-221

Total Segment Length:	57.27 km		
Recommendations:			
Delete/replace this segment "of concern": 79% overlap with Greater sage-grouse PACs.			
CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.83	3.64	7.95	1.90

Listed as 'Of concern' In settlement agreement. Why?:

WY: sage-grouse core area and habitat, National Historic Trail, BLM special management area.

230-248

230-248

Total Segment Length:	77.36 km		
Recommendations:			
Re-route to avoid resources "of concern." Consult with USFWS to avoid adverse modification to Northern spotted owl designated critical habitat.			
CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.71	2.67	4.05	5.44

Listed as 'Of concern' In settlement agreement. Why?:

OR: critical habitat, National Register of Historic Places property, Pacific Crest Trail, Clackamas Wild & Scenic River and other “eligible” segments under Wild & Scenic Rivers Act, conflicts with Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves.

11-228

11-228

Total Segment Length:	240.06 km		
Recommendations:			
Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (30% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.			
CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.68	9.15	5.32	1.07

264-265

264-265

Total Segment Length:	20.37 km		
Recommendations:			
Delete/replace this segment "of concern." This segment scores "Very High" risk for both CHAT and Imperiled Species. Consult with USFWS to avoid adverse modification to California red-legged frog designated critical habitat within 2 km.			
CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.45	4.01	3.10	7.36

Listed as 'Of concern' In settlement agreement. Why?:

CA: critical habitat, National Conservation Area, citizen-proposed Wilderness, USFS Inventoried Roadless Area.

224-225

224-225

Total Segment Length:	138.23 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.50	2.44	8.40	3.06

23-25

23-25

Total Segment Length:	68.13 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat.

Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert. Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible. This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.10	7.59	6.50	1.75

Listed as 'Of concern' In settlement agreement. Why?:

CA: critical habitat, National Conservation Area, Area of Critical Environmental Concern.

6-15

6-15

Total Segment Length:	44.28 km

Recommendations:

Consult with USFWS to avoid adverse modification to Webber Ivesia designated critical habitat within 2 km.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.21	5.72	4.29	2.66

24-228

24-228

Total Segment Length: 90.61 km

Recommendations:
Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (58% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.03	9.11	4.11	1.44

Listed as 'Of concern' In settlement agreement. Why?:
ID: sage-grouse habitat, pygmy rabbit habitat. OR: sage-grouse habitat, National Register of Historic Places property.

61-207

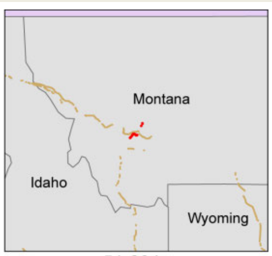
61-207

Total Segment Length: 142.90 km

Recommendations:
Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.90	5.94	4.55	2.08

51-204



51-204

Total Segment Length: 21.64 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.97	2.79	2.68	3.90

5-201

5-201

Total Segment Length: 8.97 km

Recommendations:
Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.36	6.08	2.20	1.17

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Public Input

101-263

Total Segment Length: 41.73 km

Recommendations:

Re-route to avoid resources "of concern." Consult with USFWS to avoid adverse modification to designated Northern spotted owl critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.88	4.12	2.35	3.29

Listed as 'Of concern' In settlement agreement. Why?:

CA: critical habitat; WSR; CA-proposed Wilderness, citizen-proposed Wilderness, USFS Inventoried Roadless Area.

15-104

15-104

Total Segment Length: 82.54 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (52% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult with USFWS to avoid adverse modification to Webber Ivesia designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.87	6.53	5.01	1.10

46-269

46-269

Total Segment Length: 106.23 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
1.43	8.84	6.50	1.14

Listed as 'Of concern' In settlement agreement. Why?:

AZ: proposed and designated Wilderness areas, Wild and Scenic Rivers, Three Rivers Area of Critical Environmental Concern.

136-277

136-277

Total Segment Length: 12.53 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.56	4.34	4.97	2.01

47-231

47-231

Total Segment Length: 96.11 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to razorback sucker, desert tortoise, and bonytail chub designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.81	5.08	6.42	2.48

Listed as 'Of concern' In settlement agreement. Why?:

AZ: desert tortoise and bonytail critical habitat, Area of Critical Environmental Concern, Lake Mead National Recreation Area.

130-131 (S)

130-131 (S)

Total Segment Length: 6.46 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.70	3.84	7.21	0.58

111-226

111-226

Total Segment Length: 50.31 km

Recommendations:

Delete/replace: 100% overlap with Greater sage-grouse PACs.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.84	5.39	6.75	0.48

41-46

41-46

Total Segment Length: 62.32 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.22	4.93	6.32	2.06

Listed as 'Of concern' In settlement agreement. Why?:

AZ: impacts to Black Mountain population for desert tortoises.

43-44

43-44

Total Segment Length: 26.59 km

Recommendations:

Delete/replace: 84% overlap with Greater sage-grouse PACs.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.34	5.28	8.35	0.27

80-273

80-273

Total Segment Length: 126.89 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.41	5.95	6.29	0.52

73-129

73-129

Total Segment Length: 10.99 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.68	6.80	6.27	1.53

121-220

121-220

Total Segment Length: 10.79 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (43% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.06	3.59	6.19	1.86

130-131 (N)

130-131 (N)

Total Segment Length: 24.90 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.44	3.38	6.06	0.92

47-68

47-68

Total Segment Length: 30.48 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.75	2.68	6.21	0.00

51-205

51-205

Total Segment Length: 14.50 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.11	0.00	2.86	4.06

130-274

130-274

Total Segment Length: 59.65 km

Recommendations:
Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.74	6.50	5.92	0.32

Listed as 'Of concern' In settlement agreement. Why?:

CO: access coal, directly or indirectly impacts Gunnison sage-grouse conservation areas, occupied Gunnison sage-grouse habitat, CO-proposed Wilderness, USFS IRA.

55-240

55-240

Total Segment Length: 39.79 km

Recommendations:
Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.98	4.53	3.76	3.47

134-136

134-136

Total Segment Length: 20.24 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.49	5.03	7.79	0.00

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126-133

Total Segment Length: 61.52 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (33% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.23	5.02	5.63	0.08

49-202

49-202

Total Segment Length: 16.77 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (23% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
1.27	4.99	7.03	0.42

144-275

144-275

Total Segment Length: 72.80 km

Recommendations:

Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (21% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.84	9.82	4.81	0.48

Listed as 'Of concern' In settlement agreement. Why?:

CO: coal, wilderness, National Historic Places.

16-24

16-24

Total Segment Length: 228.89 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (12% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.76	9.09	5.70	0.78

Listed as 'Of concern' In settlement agreement. Why?:

NV: Wilderness, National Conservation Area, National Historic Place, BLM Wilderness Study Area (in Oregon).

78-138

78-138

Total Segment Length: 39.48 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (46% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.74	4.53	4.96	1.99

7-8

7-8

Total Segment Length: 4.36 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.72	0.00	5.17	2.34

102-105

102-105

Total Segment Length: 78.64 km

Recommendations:

Re-route to avoid resources "of concern." Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to designated Northern spotted owl and Marbled murrelet critical habitat. No imperiled species score was available for this segment, but the presence of extensive critical habitat suggests a need to identify and where present avoid impacts to geographic areas for recovery units for threatened and endangered species.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.72	2.46	1.15	

Listed as 'Of concern' In settlement agreement. Why?:

WA: numerous “suitable” segments under Wild & Scenic Rivers Act, borders designated Wilderness, Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves, crosses Pacific Crest Trail, tracks America’s Byway within 1 mile, National Register of Historic Places property.

110-114

110-114

Total Segment Length: 215.26 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (4% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.55	5.74	5.89	1.36

Listed as 'Of concern' In settlement agreement. Why?:

NV: sage-grouse habitat, undisturbed, USFS Inventoried Roadless Area. UT: much undisturbed, National Historic Place, BLM Wilderness Study Area, UT-proposed Wilderness.

110-233

110-233

Total Segment Length:	255.90 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (14% overlap). Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.92	5.82	8.25	0.58

Listed as 'Of concern' In settlement agreement. Why?:

NV: sage-grouse habitat.

11-103

11-103

Total Segment Length:	28.10 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.56	0.00	5.07	0.60

112-226

112-226

Total Segment Length:	53.48 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (53% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.95	2.64	4.60	0.00

113-114

113-114

Total Segment Length:	140.01 km

Recommendations:

Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs, Sonoran DT Cat I & II habitat, and Mojave DT P1 & P2 habitat. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (6% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.06	6.49	5.81	2.16

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113-116

Total Segment Length: 144.01 km

Recommendations:

Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs, Sonoran DT Cat I & II habitat, and Mojave DT P1 & P2 habitat. Consult with USFWS to avoid adverse modification to Desert tortoise, Southwestern willow flycatcher, Virgin River chub, Woundfin, and Holmgren milk-vetch (within 2 km) designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.48	3.25	7.22	3.61

114-241

114-241

Total Segment Length: 216.26 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (16% overlap).

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.42	6.66	6.66	0.94

115-208

115-208

Total Segment Length: 63.44 km

Recommendations:

Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.00	4.47	4.00	1.10

115-238

115-238

Total Segment Length:	244.42 km

Recommendations:

Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat. Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert. This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.37	4.17	5.65	1.81

121-240

121-240

Total Segment Length:	27.54 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (45% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.11	2.56	6.94	1.53

129-218

129-218

Total Segment Length:	34.61 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.64	3.57	7.01	1.87

129-221

129-221

Total Segment Length:	13.50 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.05	0.00	2.97	1.86

130-274 (E)

130-274 (E)

Total Segment Length:	7.10 km

Recommendations:
Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.27	7.00	8.75	0.00

Listed as 'Of concern' In settlement agreement. Why?:
CO: access coal, directly or indirectly impacts Gunnison sage-grouse conservation areas, occupied Gunnison sage-grouse habitat, CO-proposed Wilderness, USFS IRA.

131-134

131-134

Total Segment Length:	11.72 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.03	0.00	5.95	0.00

132-276

132-276

Total Segment Length:	59.97 km

Recommendations:
Consult with USFWS to avoid adverse modification to Razorback sucker and Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.91	5.90	5.49	1.12

133-142

133-142

Total Segment Length:	11.58 km

Recommendations:
Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (47% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to Colorado pikeminnow designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.78	1.96	5.50	0.92

134-139

134-139

Total Segment Length: 14.83 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.58	4.57	5.59	0.54

136-139

136-139

Total Segment Length: 8.06 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.97	0.00	6.44	0.50

139-277

139-277

Total Segment Length: 7.62 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.65	0.00	4.90	2.79

15-17

15-17

Total Segment Length: 34.02 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.56	5.75	6.65	0.83

16-104

16-104

Total Segment Length: 106.70 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (73% overlap).

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.04	6.66	7.01	0.11

Listed as 'Of concern' In settlement agreement. Why?:

NV: BLM Wilderness Area.

16-17

16-17

Total Segment Length:	83.03 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.85	4.22	6.33	0.25

17-18

17-18

Total Segment Length:	69.29 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.87	4.31	7.41	1.24

17-35

17-35

Total Segment Length:	224.88 km

Recommendations:
Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (14% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.36	6.69	5.15	0.28

Listed as 'Of concern' In settlement agreement. Why?:
NV: access to coal plant, impacts to sage-grouse habitat.

18-224

18-224

Total Segment Length:	394.87 km

Recommendations:
Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of P1 & P2 habitat. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.80	7.42	8.17	0.93

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Public Input

218-240

Total Segment Length: 24.87 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (7% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.85	0.00	4.99	2.11

219-220

219-220

Total Segment Length: 4.81 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.18	0.00	4.68	1.86

220-221

220-221

Total Segment Length: 23.69 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.69	2.58	5.11	1.54

223-224

223-224

Total Segment Length: 102.49 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult closely with state fish and game agencies and the US Fish and Wildlife Service to ensure that valuable wildlife resources are protected from the "Very High" risk to Imperiled Species posed by this segment. Identify and where present avoid impacts to geographic areas for recovery units for threatened and endangered species.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.91	0.00	7.86	8.01

Listed as 'Of concern' In settlement agreement. Why?:

NV: Areas of Critical Environmental Concern, Desert National Wildlife Refuge.

225-231

225-231

Total Segment Length:	9.68 km

Recommendations:
Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.18	0.00	5.84	1.09

229-254

229-254

Total Segment Length:	176.72 km

Recommendations:
Re-route to avoid resources "of concern." Consult with USFWS to avoid adverse modification to Bull Trout designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.78	2.60	2.70	3.72

Listed as 'Of concern' In settlement agreement. Why?:
ID: critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act. MT: critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act, Continental Divide Trail, USFS Inventoried Roadless Area.

232-233 (W)

232-233 (W)

Total Segment Length:	55.14 km

Recommendations:
Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity.   Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.71	8.19	7.00	0.69

244-245

244-245

Total Segment Length: 3.87 km

Recommendations:

Re-route to avoid resources "of concern." Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk. Consult with USFWS to avoid adverse modification to Northern spotted owl designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.38	0.00	2.22	

Listed as 'Of concern' In settlement agreement. Why?:

WA: conflicts with Northwest Forest Plan, critical habitat, tracks America's Byway.

250-251

250-251

Total Segment Length: 18.28 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (14% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.19	0.00	0.63	0.94

256-257

256-257

Total Segment Length: 4.45 km

Recommendations:

Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.43	0.00	3.24	0.00

27-266

27-266

Total Segment Length:	31.95 km

Recommendations:

While this segment intersects a Tortoise Conservation Area, it is aligned with a major interstate highway corridor and existing transmission facilities. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible.
Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat.
Limit expansion of transmission and limit additional road construction that would lead to OHV route proliferation in Mohave
Ground Squirrel modeled habitat. Consult the Desert Manager's Group regarding parcels that are priority habitat for MGS due their designation as "core" or "linkage" areas, and re-route to avoid impacts to these parcels. Within MGS habitat, minimize the area of disturbance and avoid clearing of vegetation and grading where possible.
This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region.
Consult with USFWS to avoid adverse modification to desert tortoise and Southwestern willow flycatcher (within 2 km) designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.22	1.74	7.11	1.97

29-36

29-36

Total Segment Length:	53.11 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
1.32	7.47	5.50	0.56

30-52

30-52

Total Segment Length:	157.27 km

Recommendations:

This corridor already has a large amount of existing transmission infrastructure. There is a bottleneck around the San Gorgonio Pass where it has been challenging in the past to site additional transmission. This corridor should be developed only if a technological solution is found to placing additional transmission infrastructure through the San Gorgonio Pass. Routing transmission anywhere else in the area would significantly impact the existing natural and biological resources.
This segment intersects Sonoran Desert Tortoise Category I and II management habitat and Mojave Tortoise Conservation Areas. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy.
Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Sonoran DT Cat. I & II habitat, TCAs, and Mojave DT P1 & P2 habitat. Follow locally-specific connectivity recommendations, such as those for the Southern California Wildlands Linkages and Arizona Missing Linkages, to avoid connectivity impacts to Desert Bighorn Sheep in the Mojave Desert. This corridor segment intersects a Southern California Wildlands Linkage. Please see general recommendations for maintaining connectivity in this region. Consult with USFWS to avoid adverse modification to Coachella Valley milk-vetch, Coachella Valley fringe-toed lizard, razorback sucker, and desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.07	3.29	4.19	1.72

35-111

35-111

Total Segment Length: 28.70 km

Recommendations:

Delete/replace: 100% overlap with Greater sage-grouse PACs.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.88	2.98	2.96	0.76

36-112

36-112

Total Segment Length: 24.71 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.42	0.00	5.43	0.00

36-226

36-226

Total Segment Length: 63.05 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (12% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.32	2.48	5.89	0.00

36-228

36-228

Total Segment Length: 118.38 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.44	7.55	5.48	0.38

37-223 (N)

37-223 (N)

Total Segment Length: 10.56 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Re-route to avoid "Very High" risk to permeability, and work closely with state and federal wildlife and science agencies to ensure that connectivity is maintained. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.00	1.99	10.00	1.53

37-223 (S)

37-223 (S)

Total Segment Length: 18.87 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.98	0.00	7.68	1.64

37-232

37-232

Total Segment Length: 79.99 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.50	0.00	6.81	2.08

37-39

37-39

Total Segment Length: 14.44 km

Recommendations:

Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.97	0.00	7.34	1.18

3-8

3-8

Total Segment Length: 56.11 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (9% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.37	7.53	4.99	1.29

39-113

39-113

Total Segment Length: 80.04 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat. Consult with USFWS to avoid adverse modification to desert tortoise designated critical habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.45	2.46	7.48	2.37

Listed as 'Of concern' In settlement agreement. Why?:

NV: Pahranagat National Wildlife Refuge, Rainbow Gardens ACEC, near proposed Gold Butte National Conservation Area, Black Mountain tortoise habitat.

39-231

39-231

Total Segment Length: 49.44 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Tortoise Conservation Areas without existing transmission, and minimize additional transmission siting in TCAs. If additional transmission is permitted, site as close together as possible and with as little ground disturbance and vegetation clearing as possible. Re-route to avoid siting new facilities in Priority 1 & 2 Connectivity Habitat without existing transmission, and minimize additional transmission siting in these areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of TCAs and P1 & P2 habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.96	0.00	5.31	2.00

Listed as 'Of concern' In settlement agreement. Why?:

NV: Pahranagat National Wildlife Refuge, Rainbow Gardens ACEC, near proposed Gold Butte National Conservation Area, Black Mountain tortoise habitat.

41-47

41-47

Total Segment Length: 22.05 km

Recommendations:

Re-route to avoid resources identified as "of concern." Re-route to avoid siting new facilities in Sonoran Desert Tortoise Category I and II management habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
0.15	3.40	5.11	2.87

Listed as 'Of concern' In settlement agreement. Why?:

AZ: impacts to Black Mountain population for desert tortoise.

43-111

43-111

Total Segment Length: 31.97 km

Recommendations:

Delete/replace: 100% overlap with Greater sage-grouse PACs, scores "Very High" for both Permeability and CHAT risk scores.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.64	3.72	9.05	0.67

44-110

44-110

Total Segment Length: 177.38 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (53% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.53	4.14	7.51	1.40

Listed as 'Of concern' In settlement agreement. Why?:

NV: sage-grouse habitat.

44-239

44-239

Total Segment Length: 106.66 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.19	1.65	5.42	0.32

49-112

49-112

Total Segment Length: 72.92 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
2.00	5.05	4.85	0.00

50-51

50-51

Total Segment Length: 7.87 km

Recommendations:
Delete/replace this segment. This segment scores "Very High" risk for both CHAT and Imperiled Species.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
7.81	0.00	3.27	6.64

66-209

66-209

Total Segment Length: 9.58 km

Recommendations:
Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at "Very High" risk.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
8.08	0.00	3.73	1.71

7-11

7-11

Total Segment Length: 141.06 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.97	6.78	5.07	1.11

73-138

73-138

Total Segment Length: 10.73 km

Recommendations:

Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (14% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
5.51	0.00	5.58	2.29

78-255

78-255

Total Segment Length: 45.72 km

Recommendations:

Re-route to avoid resources "of concern." Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Greater Sage-grouse PACs (41% overlap). Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.83	3.57	5.28	2.68

Listed as 'Of concern' In settlement agreement. Why?:

WY: sage-grouse core area and habitat.

78-85

78-85

Total Segment Length: 16.15 km

Recommendations:

Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.81	0.00	4.54	2.40

81-213

81-213

Total Segment Length: 82.80 km

Recommendations:

None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.94	6.46	5.16	0.23

81-272

81-272

Total Segment Length:	162.20 km

Recommendations:
Re-route to avoid resources "of concern." Re-route to avoid "Very High" risk to the number and magnitude of flowline crossings by WWEC segments. Where flowlines must unavoidably be crossed, minimize impacts to connectivity. Consult with USFWS to avoid adverse modification to Southwestern willow flycatcher and Rio Grande silvery minnow designated critical habitat within 2 km.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
4.58	10.00	5.33	1.98

Listed as 'Of concern' In settlement agreement. Why?:
NM: Sevilleta National Wildlife Refuge, National Conservation Areas.

87-277

87-277

Total Segment Length:	125.01 km

Recommendations:
Re-route to avoid resources "of concern" and ensure connection to renewable energy development. Re-route or exclude new infrastructure ROWs and avoid all new energy infrastructure development within Gunnison Sage-grouse Production Areas. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of important sage-grouse breeding areas.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
6.73	3.31	5.40	1.83

Listed as 'Of concern' In settlement agreement. Why?:
CO: coal, Wilderness, sage-grouse habitat; National Historic Places.

89-271

89-271

Total Segment Length:	111.13 km

Recommendations:
None.

CHAT Score	Flowlines Score	Permeability Score	Imperiled Species Score
3.67	5.70	5.08	1.05

Appendix C Detailed Methodology

As discussed elsewhere in this comment letter, we did not attempt to forecast wildlife risk based on a set of predictors in a formal modeling framework. Instead, we selected key products from existing analyses that represent Defenders' conservation priorities around preserving, protecting, and restoring imperiled species, particular key species, habitat connectivity, and intact habitat. Using these accepted, peer-reviewed landscape assessment data, we produced four lists that rank all WWECs in terms of risk, then explored relevant differences in these ranked lists. As a final step, we performed an analysis to create a single ranked list based on all four lists. Through this assessment, which takes existing peer-reviewed rankings, processes them with transparent criteria into multiple ranked lists, then creates a synthesis list based on numerical optimization methods, we feel we have provided a quantitative overview of the WWECs through the lens of several accepted ranking methodologies. We encourage the BLM and USFS to use our recommendations to prioritize high-risk WWECs for further analysis. However, we emphasize that this will require BLM and USFS to further develop their own predictive models that synthesize quantitative field data using a replicable modeling process to successfully estimate risk to a wide variety of Special Status Species and ecoregions from the various impacts of transmission development.

Use of a quantitative and transparent modeling process for comprehensive evaluation of the WWECs by BLM and USFS, as opposed to one based on expert opinion, is especially relevant in situations such as this where the previous decisions of the agencies have been challenged on the basis of inadequate and subjective review. It is important that the record be set straight on the WWECs so that they are developed in the public's best interest with no ambiguity about the validity of the process. On a policy level, this provides strong justification for a more transparent and unimpeachable process. In addition, data-based models have several other vital advantages over judgment based models, such as the ability to quantify how much error is in the predictions, examine the relative contributions of various predictors to the model, and so on. For these reasons, we strongly recommend that further analysis of the WWECs, in particular those deemed to be "High" or "Very High" risk by our analysis, be done within this type of framework.

Methodologies for Coarse-Scale Wildlife Risk Analyses

Western Governors' Association Crucial Habitat Assessment Tool: State conservation priorities across the landscape

The WGA CHAT "aims to bring greater certainty and predictability to planning efforts by establishing a common starting point for discussing the intersection of development and wildlife."[32] Although it is not intended for project-level assessment, it does represent a broad and fairly comprehensive look across the landscape that is an attempt to encapsulate the conservation priorities of each state. The final CHAT rank assigned to each part of the landscape was developed based on inclusion of the following datasets:

- Tier 1 Data (minimum standard for inclusion across all states):
  - Habitats for "Species of Concern", including federally or state listed or candidate species, species identified in a State Wildlife Action Plan or Comprehensive Wildlife Conservation Strategy, ranges for plant and animal species with special protective rankings (e.g. NatureServe Natural Heritage global ranks), and priority habitats for the management of "core conservation populations".
  - Native and Unfragmented Habitat blocks
  - Riparian and Wetland Habitats
  - Connectivity or Linkage Assessment

[32] http://www.westgov.org/initiatives/wildlife/102-articles/initiatives/380-chat

- Quality Habitat for other Species of Importance (for example, game and sport fish species not otherwise included as a "Species of Concern")
- Tier 2 Data (lower priority for inclusion, can be important for identifying crucial habitat and corridors and maintaining conservation objectives):
    - Terrestrial or Aquatic Native Species Richness
    - Valued Lands
    - Important Restoration Habitat

States then developed methodologies to "Roll-up" these datasets in ways that would reflect their conservation priorities. States used a combination of categorical (where Tier 1 values were categorized and prioritized up-front, resulting in simple, non-mathematical techniques for determining final ranks) and weighted sum (where mathematical equations were developed to combine Tier 1 layers) methodologies to arrive at their final Crucial Habitat ranks. These final ranks, based as they are on a combination of data, judgments, and prioritizations, should be understood to represent the consensus of each state natural resource management agency regarding the conservation needed to meet targets in each State Wildlife Action Plan.

To assess Western states' wildlife and habitat conservation priorities, we acquired the Crucial Habitat Assessment Tool dataset,[33] which consists of 1- or 3-km hexagons scored using a state-generated Crucial Habitat rank of 1-6. We edge-matched the various state datasets to generate a contiguous, West-wide coverage and then calculated the area-weighted average (AWM) Crucial Habitat rank for each WWEC segment. For display and tabulation, those results were then re-scored on a 0-10 scale, such that 10 correlates with the highest CHAT rank (1) and 0 correlates with the lowest CHAT rank (6).

Landscape permeability and connectivity

The **Landscape Permeability Rank** dataset was created by Theobald et. al.[34] by beginning with an extensive model of "naturalness," or the inverse of human disturbance, incorporating land cover types, housing density, roads and highway traffic, all adjusted by tree cover and slope. Next, the authors calculated how similar each cell across the landscape in this naturalness model was to its neighbors, generating a model for how species might be able to "percolate" across a landscape made up of a continuous gradient of "permeability." Each cell on the landscape was assigned a Permeability Rank value as a result of this model.

The **Permeability Flowlines** dataset was built by using the landscape permeability data as a surface, then identifying how important each individual cell is to the connectivity of its neighbors. Using this metric, known as "betweenness centrality," along with many simulations of "travel" between various random locations on the landscape, the authors of the data were able to create a map that shows connectivity "flowlines" across the landscape, with those of higher betweenness centrality values representing more valuable connective flowlines.

We acquired Theobald et. al.'s datasets on Landscape Permeability Rank (a raster dataset with a "permeability rank" score for each pixel across the landscape) and Permeability Flow (a vector dataset displaying "flowlines" connecting areas of high permeability across the landscape).

For the Landscape Permeability Rank, we first inverted the values in the dataset such that the highest value of 717 represents the highest Landscape Permeability and 1 the lowest. We then overlaid the corridor segment polygons on the Landscape Permeability value surface, and summarized those distinct Permeability values

[33] Most states' CHAT data available from the Western Governor's Association CHAT website at http://westgovchat.org/. California Department of Fish and Wildlife, Arizona Game and Fish Department, and Colorado Parks and Wildlife provided their CHAT data separately.
[34] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x

captured within each segment. We scaled these values based on the proportional area they occupied within each segment, then summed them for each corridor segment arriving at an area-weighted cumulative impact score for Landscape Permeability affected by each segment. For display and tabulation, results were re-scored on a 0-10 scale,[35] such that a Landscape Permeability Cumulative Impact score of 10 correlates with the highest area-weighted sum of permeability values amongst the corridor segments (710.6) and a Landscape Permeability Cumulative Impact score of 0 correlates with the lowest area-weighted sum of permeability values (72.9).

For the Permeability Flow dataset, we analyzed how the identified flowlines intersect with the corridor segments in two ways, then combined them to yield an overall impact result. First, the flowlines themselves are scored based on how strong a connectivity pathway they represent. Using these values we identified the maximum value flowline that intersects with each corridor segment. We then calculated how many individual flowlines intersect each segment, and weighted this number based on the length of each segment. Finally, we combined those two metrics and re-scored the result on a 0-10 scale to yield an overall score for the impact of each corridor segment on the connectivity of the landscape.

Threatened and Endangered Species

We calculated the distance (in meters) to the closest portion of each species' designated critical habitat[36] to each segment. A distance of 0 m implies an overlap or intersection with that species and segment.

We used a dataset from NatureServe which presents an aggregated count for all imperiled (G1/G2 threat level) or federally listed species whose ranges overlap with each watershed (at the 12-digit Hydrologic Unit Code level, or HUC-12).[37] With this dataset we calculated the area-weighted average (AWM) number of imperiled and listed species in each watershed whose ranges might be impacted by each WWEC segment. For display and tabulation, those results were then re-scored on a 0-10 scale, such that 10 correlates with the highest AWM number of imperiled species (10.8) and 0 correlates with the lowest AWM number (0).

Categorizing risks and ranking all segments

To classify segments for display in ArcGIS, we used the Jenk's natural breaks algorithm to bin each score into five groups representing Very Low, Low, Medium, High, or Very High risks. Jenk's classifies the data through minimizing within-class variance and maximizing between-class variance,[38] g dividing the data into groups that are internally as similar as possible and as different from the other groups as possible. As a result, the cutoff points for the five groups are different for each score. However, as the scores are on a uniform range of 0-10 and reflect the initial geospatial calculations we conducted, we feel comfortable using this method to describe the risk "buckets" for each of the four scores. The buckets are reflected in the symbolization categories for the west-wide maps, and in the five colors shown for the west-wide scores on the detail table and are as follows:

[35] All four West-wide datasets were rescaled on a continuous 0-10 scale preserving the original distribution of the data, as follows: $Rescaled\ Value_{0-10} = 10 - (10 * \frac{Original\ Value - Minimum_{Original\ Dataset}}{Maximum_{Original\ Dataset} - Minimum_{Original\ Dataset}})$

[36] Critical Habitat layer available at http://ecos.fws.gov/crithab/, accessed January 2014.

[37] NatureServe Analysis of Imperiled or Federally Listed Species by HUC-12, October 2011. Note that this dataset, while extremely valuable in its detailed aggregation at the HUC-12 watershed level, does not represent the most recent available information from NatureServe (which updates its HUC-8 datasets more frequently). We used it in our analysis to provide a west-wide window onto local concentrations of imperiled species, but WWEC-specific analysis should identify best-available datasets in order to get a comprehensive understanding of potential impacts to imperiled species.

[38] See http://support.esri.com/en/knowledgebase/techarticles/detail/26442, citing Jenks, George F. 1967. "The Data Model Concept in Statistical Mapping", International Yearbook of Cartography 7: 186-190.

	CHAT	Permeability	Flowlines	Imperiled
Very High	7.2-10	8-10	7.7-10	5.9-10
High	5.4-7.1	6.5-7.9	6.1-7.6	3.0-5.8
Medium	3.8-5.3	5.3-6.4	4.1-6	1.7-2.9
Low	1.8-3.7	3.6-5.2	0.1-4	0.8-1.6
Very Low	0-1.7	0-3.5	0	0-0.7

We tested for relationships amongst the individual rankings across the four West-wide scores using **Kendall's Tau statistic** to examine correlations between each pair of ordered lists. We saw generally very low scores for correlations and high p-values. The ranked lists did not correlate well amongst themselves, suggesting that they measured different aspects of wildlife risk across the landscape. We did not attempt interpret additional relationships amongst the four scores, and simply interpreted each score individually for each segment.

In order to present the segments roughly ordered from highest to lowest risk, we used the **RankAggreg R package** to aggregate multiple ranked CHAT lists.[39] This method sums the absolute differences between the ranks of all unique elements from all ordered lists combined, analyzing the lists repeatedly to find the optimal list of k top members (user specified) that minimizes the sum of ranked differences. We used k = 66 to rank the top half of the WWEC segments.

The remaining segments after WWEC segment 7-8 were left unranked and listed in alphabetical order by segment name since we had no basis to rank them using the RankAggreg analysis.

Methodologies for Species-Specific Wildlife Risk Analyses

Desert tortoise

Desert tortoise are known to be impacted by corvid predation upon juveniles. Ravens and other corvids have been shown to range as far as 4.3 miles[40] in either direction from transmission lines in some landscapes, greatly increasing the potential threat from linear corridor development to the tortoise. Accordingly, we conducted our analyses on potential impacts to desert tortoise using a 4-mile buffer on either side of the designated corridors. With extensive data availability on desert tortoise and their status as a priority indicator species for the southwestern deserts, we looked for intersection within 4 miles for each of the following important habitat models:

- Tortoise Conservation Areas - Critical habitat, in addition to National Park Service lands and other conservation areas or easements managed for desert tortoises, constitutes the primary component of tortoise conservation areas. These were identified in the 2011 Recovery Plan for Mojave desert tortoise.[41]
- FWS Priority 1 Connectivity Habitat (Least cost corridors): Identified by FWS[42] as modeled

[39] Pihur, V., S. Datta, and S. Datta. 2009. RankAggreg, an R package for weighted rank aggregation. BMC Bioinformatics 2009, 10:62.
[40] Boarman, W., B. Heinrich. 1999. Corvus corax: Common Raven. The Birds of North America, 476: 1-32; Leu, M., Hanser, S.E., and Knick, S.T., 2008, The human footprint in the west-A large scale analysis of anthropogenic impacts: Ecological Applications, v. 18, p. 1119-1139.
[41] Need data source.
[42] Averill-Murray et al. 2013 "Conserving Population Linkages for the Mojave Desert Tortoise." Herpetological Conservation and Biology 8(1) 1-15.

connectivity corridors for the desert tortoise based on USGS model for Mojave desert tortoise.[43]
- FWS Priority 2 connectivity habitat (High value contiguous habitat): This was identified by FWS as modeled high quality habitat for Mojave desert tortoise based on the 2009 USGS model.[44]
- AZ BLM Sonoran Desert Tortoise management units categories I and II,[45] which in the detailed report we describe as "important" habitat in accordance with AZ BLM's Sonoran Desert Tortoise management policy.[46] The BLM considers these categories to be (or to be likely to be) essential to the maintenance of viable and/or large populations of the species, and either supporting a medium to high density population or with a low density population contiguous to one of higher density. An additional category, III, is considered by the agency to be "not essential to maintenance of viable populations"[47] and is subject to less protective management guidelines.

Mohave Ground Squirrel

In 2013, the USGS in collaboration with California State University Stanislaus and University of Nevada, Reno, completed an updated habitat model for the Mohave ground squirrel.[48] Maximum entropy software was used to model current suitable habitat for Mohave ground squirrel and suitable habitat under various future scenarios of anthropogenic and utility-scale renewable energy development. Suitable habitat for Mohave ground squirrel under the medium development impact scenario was categorized into a binary representation of suitable and unsuitable habitat (using the 5th percentile of habitat suitability scores, 0.438, as the threshold) for all cells with MGS occurrences. Based on examination of species observation data and consultation with USGS biologists, Conservation Biology Institute masked the USGS Mojave ground squirrel model output to the union of the MGS historic range (provided by P. Leitner) and the USFS ecoregion subsections overlapping the historic range, which contain MGS observations. This masking process excludes the Maxent predicted habitat at the southern end of the DRECP study area, which experts indicate should be omitted from the model output.

The resulting masked model output was used to identify WWEC sections that intersect Mohave ground squirrel habitat.

Greater sage grouse

Similar to Desert tortoise (described above), sage grouse are at risk from increased corvid predation due to perching opportunities made possible by transmission line penetration, especially upon the young.[49] Accordingly, we have concentrated our analyses on high-density breeding grounds within four miles of a

[43] Nussear, K.E., Esque, T.C., Inman, R.D., Gass, Leila, Thomas, K.A., Wallace, C.S.A., Blainey, J.B., Miller, D.M., and Webb, R.H., 2009, Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona: U.S. Geological Survey Open-File Report 2009-1102, 18 p. Available at http://pubs.usgs.gov/of/2009/1102/.
[44] ibid.
[45] AZ BLM Suitable Desert Tortoise habitat (1992). Metadata available at http://www.blm.gov/az/GIS/meta_files/az_tortoise.html.
[46] Management policy as quoted in AZ BLM (2012), "Desert Tortoise Mitigation Policy." Available at http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/efoia/2012IM_IB.Par.65054.File.dat/IMAZ-2012-031.pdf. The original management goals are articulated in Spang, E.F., G.W. Lamb, F. Rowley, W.H. Radtkey, R.R. Olendorff, E.A. Dahlem, and S. Slone (1988). Desert tortoise habitat management on the public lands: A rangewide plan. Report prepared for Bureau of Land Management, Division of Wildlife and Fisheries, 903 Premier Building, l8th and C Streets, N. W., Washington, D.C. 20240. 23 pp.
[47] ibid.
[48] Inman RD, Esque TC, Nussear KE, Leitner P, Matocq MD, Weisberg PJ, Diltd TE, Vandergast AG. (2013) Is there room for all of us? Renewable energy and Xerospermophilus mohavensis. Endang Species Res 20:1-18
[49] NTT Report 2011.

WWEC segment,[50] and on Priority Areas for Conservation (PACs),[51] designated by the states in consultation with the FWS as part of the national sage grouse conservation effort. We calculated whether or not a WWEC segment intersects important or "core" sage grouse breeding habitat (a density of up to 75% of all individuals use that habitat), and what percent of each WWEC segment's area overlaps with a PAC.

Gunnison sage grouse

We conducted a similar analysis for Gunnison Sage-Grouse as we did for Greater Sage-Grouse core areas, described above. We acquired Colorado Parks and Wildlife's data layer on Gunnison Sage-Grouse Production Areas, which consists of active leks surrounded by a four-mile buffer zone,[52] and looked for intersection with the WWEC segments plus a four-mile buffer to account for corvid predation.

[50] Doherty, K. E., Tack, J. D., Evans, J. S., & Naugle, D. E. (2010). Mapping breeding densities of greater sage-grouse: a tool for range-wide conservation planning. Completion report to the Bureau of Land Management for Interagency Agreement, (L10PG00911). http://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/Documents/BLM-L10PG00911.pdf

[51] U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013. Supplementary datasets for Priority Areas for Conservation (PACs) were provided by state Fish & Game agencies. Overall greater sage grouse current range dataset was provided by WA Department of Fish and Wildlife.

[52] Colorado Parks and Wildlife. 2013. CPW Gunnison's Sage Grouse Shapefile Download. Available at http://www.arcgis.com/home/item.html?id=1bab23cd9f274742ae1e38afa6e6c44f.

May 23, 2014

Department of the Interior
Department of Agriculture
Department of Energy

Comments submitted electronically to 368corridors@blm.gov

Subject: Request for Information: West-Wide Energy Corridor Review

Dear Corridor Review Team:

Idaho Power Company (IPC) is an investor-owned utility with a service area that covers a 24,000-square-mile area in southern Idaho and eastern Oregon and has an estimated population of 1,000,000. We appreciate the opportunity to comment on the Request for Information (RFI): West-Wide Energy Corridor (WWEC or Corridors) Review, and request careful consideration of the enclosed comments.

Idaho Power is currently pursuing authorization for two 500-kilovolt (kV) transmission lines in Idaho and Oregon and our experience with these projects is the basis for our comments on the WWECs. The Gateway West transmission line project (Gateway West) received partial approval in a November 2013 Record of Decision and the Boardman to Hemingway 500- kV transmission line project (the B2H Project) draft Environmental Impact Statement (EIS) is scheduled for public release in fall 2014. Segments of the WWECs evaluated for use with these projects included 36-112, 36-226, 36-228, and 29-36 for Gateway West and segment 250-251 for B2H.

Overall, the use of WWECs did not facilitate siting, permitting, or review of our Gateway West project. At times, the Corridors served as an impediment and caused confusion with agency staff and the public. The first and foremost issue as stated by the public was the lack of a robust public process to initially identify the WWECs. During the initial siting of our Gateway West project, much of the public informed us that upon reviewing the proposed route utilizing these WWECs, it was the first time they had been made aware of the Corridors.

The most common misconception among agency staff and the public was that we were required to use the Corridors; this often resulted in an initial unwillingness to consider routes outside of them. This misconception, coupled with the issue mentioned above, led to an unnecessarily hostile siting environment for both the project proponents and BLM staff. Just as significant, the disjointed nature of the Corridors (i.e., only applied to federally-managed lands) failed to account for significant resource concerns or routing constraints on private lands that often made using a WWEC segment infeasible or impracticable.

The use of a WWEC did not reduce the time it has taken to permit a project as multiple route alternatives had to be developed and project-specific surveys and analyses were still required. The high-level analysis conducted in the WWEC EIS did not adequately and/or correctly

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2014 Request for Information Public Input

characterize resources within the Corridors. For example, some segments of the designated Corridors were not practicable because of engineering concerns (e.g., severe topography).

Our initial experience with the B2H Project and the Corridors showed that there was a lack of Corridors available between the termini of the project; this is due, in part, to the lack of federal lands in the central and northern portions of the B2H Project. Where possible, the one WWEC segment was used in the southern portion of the project, but its use was trumped by potential impacts to greater sage-grouse habitat, visual resource concerns, and other routing constraints identified by federal and state agencies and the public.

States also have requirements that may make the use of a WWEC infeasible. For example, the Oregon Department of Fish and Wildlife (ODFW) has identified core and low density sage-grouse habitat regardless of the underlying land authority. Core habitat is identified as Category 1 habitat and the requirement is avoidance or ODFW will recommend denial of the project. For the B2H Project, which is going through a state siting process as well as a federal permitting process, where ODFW's Category 1 habitat overlaps a WWEC, the state process would not allow the use of the Corridor. To fully vet the federal Corridors, state requirements should be considered.

The RFI asks respondents to identify other publically available information that the Agencies should consider as part of their review. Recent agency policies and analyses that should be considered include:

- Secretarial Order No. 3330—Improving Mitigation Policies and Practices of the Department of the Interior (October 31, 2013)
- Bureau of Land Management Draft Manual Section-1794. Regional Mitigation Manual Section (no date)
- A Strategy for Improving the Mitigation Policies and Practices of the Department of the Interior (April 2014)
- National and State Strategies for the National Landscape Conservation System
- 6100 – National Landscape Conservation System Management Manual (July 13, 2012) and associated manuals
- Draft and Final EISs for the national greater sage-grouse strategy

All of these documents can affect policy, and, depending on the Records of Decision for the national sage-grouse EISs, portions of Corridors may no longer be appropriate for use or the mitigation requirement may be too high to make this a practical solution.

In addition to these federal documents, we suggest including state-based information, such as policies that may constrain siting and permitting alternatives.

The RFI requests suggestions on regional stakeholder groups to engage with – we suggest including the Western Utility Group, which developed the original western corridor study and was the catalyst behind including Sec. 368 in the Energy Policy Act of 2005. To improve local buy-in and knowledge of the Corridors, we suggested including appropriate BLM resource advisory committees as stakeholder groups.

The following comments pertain to the Interagency Operating Procedures (IOPs), as requested in the RFI:

- General #2: Several agency policies and guidance were not introduced into our projects until late in the permitting process, causing delays and cost overruns. It is of paramount importance that agency project managers and ID teams effectively and accurately identify the requirements a project must meet or comply with early in the process, and then stick to these requirements throughout the process.
- Cultural Resources #4: Our projects required a five mile cultural-related visual resource evaluation buffer. In our experience, that size of a buffer is not reasonable nor does it effectively add value to the analysis. We suggest no more than a three mile buffer. This also was identified late in the process for B2H, creating change in scope and schedule and cost overruns.
- Cultural Resources #8: Our experience suggests that public education or outreach for cultural resources is best included as part of the mitigation plan for cultural resources rather than used in a popular or general forum.
- Cultural Resources #9: While we have successfully implemented effective modeling and sampling procedures on both projects, we had one BLM district refuse to accept any sampling. Such actions by an outlier district should be unacceptable, and should be managed more effectively by the BLM National Project Manager (or agency POC).
- Visual Resources #2: The BLM is required to evaluate visual resources for its Resource Management Plans (RMPs) and all actions taking place in its planning areas, yet commonly the BLM expects the project proponent to conduct an entirely new VRM classification. This is not reasonable nor should it be the burden of the project proponent. It should be the obligation of the proponent to develop a project-specified scenery management plan consistent with the BLM’s VRM classification and RMP guidance.
- Soils, Excavation, and Blasting #5: Requiring proponents to refill foundations with excavated material may not be practical or viable. If drilled-pier concrete foundations are used, which is an industry standard on extra-high voltage lines, it is not viable to utilize the excavated materials since the hole will be filled with concrete and rebar. If direct-imbedded poles are utilized, the excavated material may impair the foundation’s structural integrity. The structural integrity of the foundation is clearly more important than what might happen to the excavated material. Even if excavated materials can be utilized, there may be more spoils available than will be used to re-fill the hole so best management practices will likely be required along with reusing the spoils. Simply applying best management practices to such material should be adequate.

We also experienced agency staff wanting to include every IOP regardless of its relevance simply because the IOPs were available. There should be very clear direction provided by the agency POC as to which IOPs are relevant and necessary and are to be applied to a project.

Finally, the RFI requests feedback on the plaintiffs proposed IOPs. Following the link provided in the RFI, and thorough searching, we could not find any documentation of such IOPs.

Idaho Power has long been a supporter of designated corridors as a mechanism to prioritize land use activities on public lands and thus preserve routes for important transmission infrastructure. However, our practical experience with the value they bring has been underwhelming. Perhaps corridors would best be suited to highly constrained areas or transmission pathways where designating space for future infrastructure is critical (e.g., mountain passes, areas constrained by wilderness, etc.).

Should you have questions or need to follow-up on any of IPC's comments, feel free to contact me.

Sincerely,

Brett Dumas

BOARD OF SUPERVISORS
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May 27, 2014

Department of the Interior
Department of Agriculture
Department of Energy
368corridors@blm.gov

Re: Request for Information – West-wide Energy Corridor Review

To Whom It May Concern:

On behalf of the Inyo County Board of Supervisors, I wish to convey our thanks to the Agencies for the opportunity to participate in the regional periodic reviews of the designated Corridors and the development of the Corridor Study. The County participated in the development of the Corridors designations, and we continue to monitor implementation.

In response to the Request for Information, Inyo County's renewable energy planning should be considered in the reviews and the Corridor Study. In particular, the Renewable Energy General Plan Amendment (REGPA)[1] that we are preparing in concert with the Desert Renewable Energy Conservation Plan should be considered in these endeavors. We intend to cross-check our work with that of the Agencies, and appreciate the Agencies keeping us informed about developments regarding the Corridors.

We believe that coordination is paramount in development of the Agencies' current work program, and repeat our earlier requests for coordination between the Bureau of Land Management and the County. These efforts will be extremely helpful in the County's renewable energy planning. We thank the Agencies for their previous efforts to brief the Board of Supervisors, and we encourage the Agencies to schedule workshops in our region to inform the public about the current work effort.

Thank you. If you have any questions, please contact the County's Administrative Officer, Kevin Carunchio, at (760) 878-0292 or kcarunchio@inyocounty.us.

Sincerely,

Rick Pucci, Chair
Inyo County Board of Supervisors

[1] Refer to http://inyoplanning.org/projects/REGPA.htm for more information regarding the REGPA.

May 14, 2014

Mr. Stephen Fusilier
BLM/ GS1170 - Realty Specialist
1849 C Street NW
Washington DC 20240

RE: West-Wide Energy Corridors

Thank you for your efforts to re-evaluate West-Wide Energy Corridors. Currently, many corridors are proposed through sensitive wildlands including national monuments, proposed wilderness areas and habitat for endangered species. A planned network of electric power line routes would crisscross the west up to 6,000 miles long, up to five miles wide and could threaten wilderness, wildlife habitat and national parks.

I urgently ask you to take a thorough look as you re-evaluate corridors and please take necessary steps to avoid siting transmission lines and pipelines in wilderness-quality lands. Specifically, I ask you to remove the corridor that runs adjacent to Arches National Park; a large energy development in this area would mar the landscape and impact spectacular red rock vistas.

Outside Arches National Park, a power line corridor is proposed alongside the park and through spectacular scenic vistas in Utah's red rock desert. Another would require cutting down old growth forests near Mt. Hood in Oregon.

We do indeed need new power lines to get electricity to our homes, but a proposed network called the West-Wide Energy Corridors could threaten American wildlands. This would be terrible. The Wilderness Act wisely states that "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

At the same time, we need to find low-conflict places for future transmission lines. This is necessary to achieve a cleaner, safer energy future. Previous transmission plans favored coal and other fossil fuels, but now we have an opportunity to bring more wind, solar and geothermal into the West's power grid than ever before and put our nation on a path towards a sustainable energy future. Please focus your efforts on areas that are important for renewable energy, such as the sunny desert southwest.

The BLM can remove corridors that currently impact national parks, wildlands and wildlife habitat. Please keep power lines away from national parks and wildlands. Please support renewable energy by finding low-impact routes for transmission lines to areas with high wind and solar potential.

Thank you for your help on behalf of America's great lands and wildlife. When President Lyndon Johnson signed the Wilderness Act, he made the following statement: "If future generations are to remember us with gratitude rather than contempt, we must leave them a glimpse of the world as it was in the beginning, not just after we got through with it."

Yours truly,

J. Capozzelli
New York

Mono County
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May 27, 2014

TO: Stephen Fusilier, Bureau of Land Management

Re: Response to Request for Information for West-Wide Energy Corridor Review

The Mono County Community Development Department appreciates the opportunity to respond to the Request for Information on the West-Wide Energy Corridor (WWEC) Review under way by the Bureau of Land Management, U.S. Department of Interior; Forest Service, U.S. Department of Agriculture; and Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. We also appreciate that the July 11, 2012, settlement provides for public input and an open and transparent process with engagement by local governments and other interested parties as part of the procedure for making potential revisions, deletions, or additions to Section 368 Corridors.

Mono County Involvement

To facilitate Mono County involvement in the corridor review, a Mono County Board of Supervisors workshop with the BLM will be scheduled in July to discuss the complex Section 368 WWEC process. As the utility corridors are assessed, additional opportunities are requested to promote local public participation, coordination and collaboration with applicable federal and state agencies. Mono County offers its Collaborative Planning Team, which consists of many affected local, state and federal agencies, as a potential outreach/participation/collaboration tool. With meetings quarterly, we would be happy to schedule a WWEC agenda item; the next CPT meeting is scheduled July 31 in Mammoth Lakes, CA.

Corridor 18-23

Corridor 18-23 passes through sensitive environmental areas of Mono County, including proposed critical habitat for the Bi-State Distinct Population Segment of the Greater Sage Grouse and habitat for the Townsend Long Eared Bat. The corridor passes through and is adjacent to important cultural resources and several designated roadless and wilderness study areas. These areas provide essential connectivity corridors and seasonal migratory habitat for a variety of wildlife including mule deer and important habitat for species that are particularly sensitive to disturbance and require very large ranges.

The corridor passes through visually sensitive terrain and is visible from several designated scenic highways, locally designated scenic routes and wilderness areas. In addition to the formal protections and constraints provided by these designations, the physical terrain also presents development obstacles. In particular, the northern portion of the corridor in Mono County crosses rugged terrain through which pipeline development would be difficult.

While the Eastern Sierra has a past history of accommodating infrastructure to serve distant populations, this particular corridor traverses sensitive terrain challenging to additional development. The corridor currently accommodates the Pacific DC intertie, but with the issues mentioned above, the feasibility of additional infrastructure development within the corridor, including additional transmission lines or energy development projects, is questionable.

Mono County and its citizens have traditionally expressed concerns on placement of new corridors and possible expansion of existing corridors and energy development projects. Due to our remote location, scenic attributes and local sensitivities, large-scale energy development is not anticipated in Mono

County. Significant renewable energy development has already occurred in Mono County, including hydro and geothermal. Recent discussions by our Board of Supervisors have been more focused on the development of a distributed, point of use, energy grid.

Alternative Corridors
We are particularly interested in reviewing appropriate alternatives, such as a corridor through southwestern Nevada. It appears that such a corridor would transverse land less sensitive both environmentally and visually, coincide with other infrastructure including a major state highway, and potentially provide better transmission connectivity from the developing energy resources of central Nevada to the rapidly growing population centers of the Southwest.

Mono County Policy
Existing Mono County policy regarding energy corridors is contained within the Mono County General Plan, and is currently under review for updating; applicable policies include:

GOAL 7: Minimize the visual and environmental impacts of electrical transmission lines and fluid conveyance pipelines.
Objective A
Electrical transmission and distribution lines and fluid conveyance pipelines shall meet the utility needs of the public and be designed to minimize disruption of aesthetic quality.

Policy 1: New major steel-tower electrical transmission facilities shall be consolidated with existing steel-tower transmission facilities except where there are technical or overload constraints or where there are social, aesthetic, significant economic, or other overriding concerns.

Action 1.1: Require selection of rights of way to preserve the natural landscape and minimize conflict with present and planned uses of land on which they are to be located.
Action 1.2: Encourage the joint use of transmission and pipeline corridors to reduce the total number of corridors and service and access roads required.
Action 1.3: Require the coordination of siting efforts so that other comparable utility uses can share rights of way in a common corridor where feasible.
Action 1.4: The County shall adopt a proactive position in the future siting of transmission and pipeline corridors by working with utilities and project proponents to specify those locations where transmission corridors are acceptable.
Action 1.5: Cooperate with the USFS and BLM in planning the use of utility corridors.

Policy 2: At the expense of the project proponent, comprehensive and detailed planning studies, including review of all feasible alternatives, shall demonstrate a clear need for new transmission lines or fluid conveyance pipelines, prior to the siting of these facilities.

Policy 3: New transmission or distribution lines or fluid pipelines shall be buried when such burial does not create unacceptable environmental impacts or the potential to contaminate shallow groundwater resources.

Policy 4: Where burial is not possible, transmission facilities and fluid pipelines shall be located in relation to existing slopes such that topography and/or natural cover provide a background where possible.

Policy 5: Transmission line rights of way shall avoid crossing hills or other high points at the crests. To avoid placing a transmission tower at the crest of a ridge or hill, space towers below the crest or in a saddle to carry the line over the ridge or hill. The profiles of facilities should not be silhouetted against the sky.

Policy 6: Where transmission line rights of way cross major highways or rivers, the transmission line towers shall be carefully placed for minimum visibility.

Policy 7: Avoid diagonal alignments of transmission lines through agricultural fields to minimize their visibility.

Policy 8: Require location of access and construction roads so that natural features are preserved and erosion is minimized. Use existing roads to the extent possible.

Policy 9: Require that materials used to construct transmission towers harmonize with the natural surroundings. Self-protecting bare steel and other types of non-reflective surfaces are appropriate in many areas. Towers constructed of material other than steel, such as concrete, aluminum, or wood should be considered. Coloring of transmission line towers to blend with the landscape should be considered.

Policy 10: Above-ground transmission lines shall be non-specular wire construction.

Objective B

Transmission and distribution lines shall not adversely impact wildlife or fisheries.

Policy 1: New transmission or distribution lines shall avoid open expanses of water and wetland, particularly those heavily used by birds. They shall also avoid nesting and rearing areas.

Policy 2: Avoid the placement of transmission or distribution lines through crucial wildlife habitats, such as deer fawning and migration areas.

Policy 3: Design transmission lines to minimize hazards to raptors and other large birds.

Sage Grouse Information

The Bi-State Action Plan for Conservation of the Greater Sage-Grouse Bi-State Distinct Population Segment (DPS), March 15, 2012, should be considered as new relevant information for the Regional Periodic Review. With over 82% of Mono County's private property within the proposed critical habitat for the Bi-State DPS, Mono County is pursuing all actions to avoid US Fish and Wildlife Service listing of the sage grouse as threatened or endangered. Mono County's primary focus is participation with the Bi-State Local Area Working Group in implementation of the Bi-State Action Plan and separately seeking legislative solutions to funding the action plan implementation. It should be noted that the Action Plan identifies the existing linear infrastructure such as Corridor 18-32 as a threat to sage-grouse.

Your consideration of these comments is appreciated. We look forward to future coordination and collaboration in the development of the Section 368 Corridor Study, beginning with the July workshop with the Mono County Board of Supervisors. Please call Associate Analyst Brent Calloway at 760.924.1809 if you have questions concerning these comments.

Sincerely,

CD Ritter for

Scott Burns
Director

cc: Jim Leddy, CAO
Mono County Board of Supervisors

Montana Department of
ENVIRONMENTAL QUALITY

Steve Bullock, Governor
Tracy Stone-Manning, Director

P. O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • Website: www.deq.mt.gov

May 27, 2013

Michael D. Nedd,
Assistant Director, Energy, Minerals, and Realty Management, Bureau of Land Management, U.S. Department of the Interior.

Tony L. Tooke,
Associate Deputy Chief, National Forest System, U.S. Forest Service, U.S. Department of Agriculture

Matt Rosenbaum,
Acting Director National Electricity Delivery, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy

Re: Montana Department of Environmental Quality's comments for the Request of Information: West-Wide Energy Corridor Review

Dear Mr. Nedd, Mr. Tooke, and Mr. Rosenbaum:

The Montana Department of Environmental Quality (DEQ) would like to thank you for the opportunity to provide comments on the West-Wide Energy Corridor Review. The only identified Section 368 Corridor under the settlement agreement in Montana was number 229-254. Corridor 229-254 generally follows the existing Bonneville Power Administration's (BPA) 500-kV line which starts near Townsend, Montana and heads west through Montana to Idaho.

DEQ's Major Facility Siting Act (MFSA) program gained experience with Section 368 Corridors in siting transmission line alternatives on NorthWestern Energy's proposed Mountain States Transmission Intertie (MSTI), a 500-kV line from south of Townsend, Montana to Southern Idaho. DEQ was the co-lead with the Bureau of Land Management (BLM) with the U.S. Forest Service as a cooperating agency for the preparation of an environmental impact statement (EIS) for the project. DEQ and BLM spent a considerable amount of time reviewing the Section 368 Corridor identified as number 229-254 to try and locate a MSTI alternative within it.

DEQ's experience on the proposed MSTI project with corridor number 229-254 should be viewed as poor, primarily as it was too narrow to accommodate another new large transmission line. The corridor is 1000 feet wide, but centered within the corridor is the existing BPA 500-kV transmission line. In the end, corridor number 229-254 is only 500 feet on the north and south side of the existing 500-kV transmission line. It appears that when 229-254 was designated the Federal agencies had failed to take into account the reliability standards from the Western Electricity Coordinating Council (WECC). WECC has certain reliability standards concerning co-location of certain large transmission lines. This narrow corridor resulted in one of the MSTI's alternatives being outside of the designated Section 368 Corridor and in some cases, off public land. After significant public concern over the alternative, NorthWestern Energy convinced WECC to waive this co-location reliability standard. It took almost two years to get this completed, including a new, compatible alternative submitted to the agencies for review in the EIS. MFSA has statutory requirements to utilize these federal designated corridors, but also has requirements to site transmission lines in compliance with WECC reliability standards. When the Federal agencies are looking to revise these Section 368 Corridors they must ensure that the corridors are in compliance with WECC reliability standards. Corridor number 229-254 might need to be widened to expand the potential of other new large transmission line projects in utilizing the designated corridor on Federal lands.

Failure to account for resource impacts in the non-federal space between sections of the 368 Corridor is a major limiting factor in efficient use of the corridors for siting purposes. The Section 368 Corridors need to be wide enough to provide flexibility in siting around potential siting constraints on Federal and private land. In Montana, Federal land is not contiguous, but is interspersed with private land. A wider corridor would provide greater siting opportunities when a linear facility alternative exits Federal land and enters private land. For example, on the MSTI project it was discovered that on corridor number 229-254 in sections 1, 2, 11, 12 of Township 6 north, Range 4 west and sections 26,27,34,35 of Township 7 north Range 4 west, there was a subdivision on the private land. Corridor number 229-254 requires a potential transmission line alternative to have to either be located in close vicinity to a subdivision or exit the Section 368 Corridor on Federal land and increase the amount of private land crossed. That would be the only way to provide an acceptable buffer around this subdivision and have to find suitable terrain to place transmission line structures while still trying to minimize impacts to other resources.

DEQ would recommend for consideration that corridor number 229-254 at a minimum be expanded to 1750 feet on the north and south side of the existing BPA transmission line, for a total corridor width of 3500 feet. This would still provide the opportunity to use some of the existing access road network that was used to build and maintain the existing BPA transmission line but also provide the needed siting flexibility when exiting Federal land on to private lands. Plus it would alleviate the WECC reliability concerns.

There are many Section 368 Corridors segments in Montana that could have local land use constraints for energy corridors due to the public/private fragmentation of lands. DEQ and BLM found that on MSTI, where isolated, discontinuous parcels in federal ownership are designated as energy corridors, it becomes counter-productive since adjacent private lands may pose substantial roadblocks to successful siting of transmission line alternatives. The potential constraints found on surrounding private lands can substantially hinder use of a designated corridor on adjacent federal lands by proposed developers. By focusing the corridor effort solely on lands in federal ownership, the placement of designated corridors in areas of Montana with mixed public-private ownership occurs in a spatial vacuum.

It does appear that the Federal agencies will be expanding their spatial analysis to state and local areas as listed in Appendix B of the Corridor Study Work Plan. DEQ would suggest that the Geographic Information System (GIS) data list include private residences, communication facilities, cropland differentiated by mechanically irrigated land, other irrigated land and dry cropland, slope, industrial activities, agricultural experiment stations, public and private airports/airfields in the vicinity of all Section 368 Corridors. These GIS datasets for Montana can be found on the following website: (http://apps.msl.mt.gov/Geographic_Information/Data/DataList/Default.aspx). The expansion of GIS datasets could ease or avoid potential impacts to neighboring private land. Separate from the GIS datasets, we would recommend visual impacts to known and potential traditional cultural properties (TCP's) should be evaluated for up to at least up to a 5 mile distance.

The Federal agencies may want to consider designating corridors in the future for transmission lines in the vicinity of major transmission line network substations. This could facilitate access to these important substations. It appears that the original corridors were developed around existing transmission lines. In many cases, this makes sense since there are already existing facilities but these transmission lines were placed there to serve a local need. Many of the potential new linear projects are looking to serve interstate load centers and have different needs than when the existing transmission lines were built. These substations could be identified by contacting the utility in charge of the balancing authority, which could identify where potential new generating facilities have expressed interest interconnecting to and where in their balancing authority these major network substations are located.

DEQ would suggest that members of the BLM and Forest Service field offices who worked on the proposed MSTI project be consulted in the review of the Section 368 Corridors, especially the designated corridor number 229-254. DEQ's Federal partners on the MSTI project could provide a first-hand account of using Section 368 Corridors from a Federal perspective.

DEQ has considerable experience with Section 368 Corridors and we recommend that we be consulted with as part of the West-Wide Energy Corridor Review process and any potential revisions to designated corridors in Montana. DEQ would be willing to identify different Section 368 Corridors that appear to need further refinement other than just corridor number 229-254 that is listed in the current settlement agreement.

Thank you again for the opportunity to share our experiences on the Section 368 Corridor number 229-254. Please add the following DEQ staff to your interested parties list: Craig Jones, DEQ, PO Box 200901, Helena, MT 59620 or crajones@mt.gov and James Strait, DEQ, PO Box 200901, Helena, MT 59620 or jstrait@mt.gov.

Sincerely,

Warren D. McCullough

Warren D. McCullough
Chief, Environmental Management Bureau

Cc: Tim Baker, Governor's office

Brian Sandoval
Governor

State of Nevada

DEPARTMENT OF WILDLIFE

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May 27, 2014

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National Forest System
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U.S. Department of Agriculture

Matt Rosenbaum
Acting Director
National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

RE: Nevada Department of Wildlife comments, RFI: Westwide Energy Corridors Review

Dear Sirs:

The Nevada Department of Wildlife (NDOW) appreciates the opportunity to review and provide comments on the review of the Westwide Energy Corridors (WWEC). We look forward to further engagement in the future and will be happy to provide additional details on our overarching comments at your convenience.

We share the concerns that not all issues relative to sensitive habitats for wildlife were adequately addressed in the WWEC FEIS. This is particularly notable in the northern portions of Nevada where sage-grouse habitats, a species shown to be particularly sensitive to transmission and other vertical structures, were not adequately avoided during the WWEC analysis and designation. Likewise, we have similar concerns with other species important to our wildlife heritage in Nevada, including bighorn sheep, desert tortoise, and mule deer to name a few.

With that said, we do appreciate the value in co-locating infrastructure that requires rights-of-way across public lands and would prefer impacts to be wisely cited and co-located to minimize habitat fragmentation and degradation of habitats from diffuse, poorly planned development.

Going forward, we would like to see the WWEC fully analyzed for impacts to wildlife and their habitats. It is unclear to us if there will be adjustments and removals of corridors as currently delineated, but we commit our assistance in providing important data, staff expertise, and cooperation if so.

Again, thank you for the opportunity to provide input on the WWEC Review.

Sincerely,

John C. Tull
Wildlife Staff Specialist, Habitat Division

DEPARTMENT OF AGRICULTURE
STATE OF NEW MEXICO

MSC 3189, Box 30005
Las Cruces, New Mexico 88003-8005
Telephone: (575) 646-3007

SUSANA MARTINEZ
Governor

JEFF M. WITTE
Secretary

May 20, 2014

Mr. Stephen Fusilier
Bureau of Land Management, Department of Interior
U.S. Forest Service, U.S. Department of Agriculture
Office of Electricity Delivery and Energy Reliability, Department of Energy

RE: Request for Information: West-Wide Energy Corridor Review *(Docket No. 14X L1109AF LLWO300000 L14300000 PN0000)*

Dear Mr. Fusilier:

New Mexico Department of Agriculture (NMDA) submits the following comments in response to the Bureau of Land Management (BLM), United States Forest Service (USFS), and Department of Energy Office of Electricity Delivery and Energy Reliability's (collectively "the Agencies") Request for Information (RFI) for the West-Wide Energy Corridor Review (79 FR 17567 – 17569; *Docket No. 14X L1109AF LLWO300000 L14300000 PN0000*).

One part of NMDA's role is to provide proactive advocacy and promotion of New Mexico's agricultural industries. Agriculture contributed $4 billion in cash receipts to New Mexico's economy in 2012 (New Mexico Agricultural Statistics, 2012). NMDA maintains a strategic goal to promote responsible and effective use and management of natural resources in support of agriculture. NMDA's comments are organized according to the questions established in the RFI for each of the two settlement provisions relevant to the RFI: the Section 368 Corridor Study and the Regional Periodic Review.

Section 368 Corridor Study

1. Are there any new or updated [GIS] data that is publicly available?

Appendix I of the Programmatic EIS and Appendix A of the Work Plan outlines many publicly available GIS databases. However, the following databases should also be included in these and other West-Wide Energy Corridor documents in the future. Both sets of GIS data are available from NMDA upon request.

- New Mexico Soil and Water Conservation District Boundaries
- New Mexico Cooperative Weed Management Area Boundaries

In addition to these existing GIS databases, NMDA strongly suggests the Agencies utilize regional and local GIS databases for nonnative and invasive species across the United States. Movement from an infested area to a noninfested area can become problematic during the construction phase of the West-Wide Energy Corridor. Knowing where nonnative and invasive species exist can help mitigate adverse effects of these construction activities.

Finally, Appendix I of the Programmatic EIS and Appendix A of the Work Plan include BLM Field Office boundaries, boundaries of existing BLM land use plans, boundaries of future BLM land use plans, and USFS Region boundaries. NMDA requests that further GIS analysis be conducted on specific land sections of the West-Wide Energy Corridor transmission designations to ensure that construction of transmission lines and other associated infrastructure does not conflict with previously designated land uses on public lands, especially grazing allotments.

Regional Periodic Review

2. *Are there any laws, regulations, or other requirements that have been implemented since issuance of the DOI and FS RODs in January 2009 that the Agencies should consider when reviewing Section 368 Corridors?*

NMDA updated New Mexico's Noxious Weed List in April 2009 (available at: http://www.nmda.nmsu.edu/apr/noxious-weed-information/). NMDA is currently in the process of revising this list, but it is unavailable at the time of writing these comments.

3. *Are there any additional regional stakeholder fora that the Agencies should consider for stakeholder engagement during regional periodic reviews?*

NMDA encourages the Agencies to include the following entities as regional stakeholders during the regional periodic reviews:

- New Mexico Department of Agriculture
- New Mexico Cattle Growers' Association
- Affected New Mexico Soil and Water Conservation Districts
- New Mexico Cooperative Weed Management Areas

4. *Are there any additions, deletions, or revisions the Agencies should consider making to the IOPs that were adopted in the DOI and FS RODs; and what is the rationale for those changes?*

The Agency Coordination section of the IOPs should include provisions to ensure that existing land uses within BLM and USFS land not be compromised – especially grazing permits. NMDA supports sustainably managed livestock grazing as a congressionally mandated use of federal lands that is vital to the ranching industry and beneficial to wildlife and associated natural resources. The importance of consistent access to forage on lands administered by the BLM and USFS cannot be overstated for the range livestock industry. Livestock grazing on federal land allotments helps maintain economic viability for producers and communities and is an important part of the custom and culture in New Mexico. More specifically, NMDA asks that the Agencies describe methods that will be used to consult with grazing permit holders prior to allowing potentially undesirable effects on rangeland from activities such as pipe- and transmission-line installation, land development, water or chemical holding areas, and other development-related activities. Proper environmental guidelines should be followed prior to, during, and after construction activities takes place on public lands to ensure the use of public lands is sustained for future generations. Further, the Agencies should limit the acres of surface disturbance as much as possible to mitigate habitat damage for livestock and wildlife.

Conclusion

Thank you for the opportunity to comment on this RFI for the West-Wide Energy Corridor Review. NMDA requests to be included in any updates or mailing lists associated with the West-Wide Energy Corridor. Please contact Ms. Lacy Levine at (575) 646-8024 if clarification of any comments is needed.

Sincerely,

Jeff M. Witte

JMW/ll/ya

Works Cited

New Mexico Agricultural Statistics – 2012. Available at:
http://www.nass.usda.gov/Statistics_by_State/New_Mexico/Publications/Annual_Statistical_Bulletin/bulletin12.asp

New Mexico Noxious Weed List – April 2009. Available at:
http://www.nmda.nmsu.edu/apr/noxious-weed-information/

Individual agency comments in response to the Request for Information:

Oregon State Parks, State Historic Preservation Office
Comments by e-mail from Dennis Griffin, State Archaeologist:

While our office can easily understand the desire to consolidate future energy related projects into a central or limited number of corridors to avoid impacts to lands throughout the state, our concerns regarding cultural resources that might be affected by such projects remain the same regardless of the area(s) selected. Impacts to significant historic properties (historic structures, archaeological sites, traditional cultural properties) will need to be assessed, hopefully avoided, but if not minimized and possibly mitigated. The majority of the proposed energy corridors that are projected through Oregon appears to predominantly cross federal lands which makes such projects much easier to manage. However, most of these lands have not ever been surveyed for archaeological sites or other historic properties. Prior to any future development, our office would want to see the results of an archaeological survey, an assessment of any historic structures, and consultation with federally recognized tribes to identify any traditional cultural properties (TCPs). Specific project effects that may occur within the proposed corridor could result in both direct and indirect effects to such properties.

While an assessment of the potential effects to specific historic properties will necessarily be tied directly to specific projects as they are developed, an initial survey of the corridors' lands should be considered an essential first step in order to identify the range and location of the historic properties within these corridors. Once the location of such properties are known, future projects can seek to evaluate, avoid, minimize or mitigate any adverse effects that may result from specific projects. It is important to understand that it will not be possible to address effects on some resources (e.g., TCPs) before project specific details are known since the type and degree of ground disturbance is directly related to the effect such activities have on these properties.

Department of Forestry
Comments from John Tokarczyk, Policy Analyst

Please accept the following response from the Oregon Department of Forestry (ODF) concerning the above. The ODF's comments are primarily related to the potential for construction, operation, and maintenance of project components that would be located across state and privately owned forest lands. In these instances project operators are responsible for review and compliance with applicable requirements found in statute and code. In addition, there is ongoing concern where proposed projects introduce the threat and or potential for creation of risk where wildfire is a concern.

With respect to wildfire risk, efforts should be sought to mitigate hazards through all phases of the proposed project. Phases include planning, construction, maintenance, completion, and removal. Risk mitigation expectations and measures are unique to each project and can be further detailed in conjunction with the ODF.

Additionally, depending on the location of any proposed project activity, operator requirements and considerations may include but are not limited to the following conditions:

State and Private Forest Lands - Project activities involving commercial forest activity on state and private forest lands are governed by the Oregon Forest Practices Act, Oregon Revised Statute (ORS) 527, and Oregon Administrative Rules (OAR) chapter 629 divisions 605 through 665. These apply even though the forest activity is a peripheral component of the project(s). The forest practice rules are intended to provide resource protection and to set standards for planning forestry practices including harvesting, road construction and maintenance, protecting water quality in waters of the state, limiting effects on specified resource sites, providing for public safety down slope of high landslide hazards, and determining reforestation or land conversion requirements. Requirements include but are not limited to:

- Operation Notification – Notification to the State Forester is required for each operation on forestland under ORS 527.670. A separate notification should be filed for each county affected by the project. All notifications require a 15 day waiting period before activity may begin unless a waiver is requested. Notifications are shared with the Department of Revenue for tax filing purposes (ORS 321.550). A notification is required for each owner involved in the project.

- Compliance with the Forest Practices Act – The clearing or harvest of forests must comply with the Forest Practices Act. The project contractor(s) must plan for harvesting techniques that comply with the harvesting rules, particularly around streams, wetlands, and specified resource sites such as sensitive habitat. The presence of certain resources in or near an operation will trigger requirements to submit written plans in conjunction with notification. Activities necessitating statutory written plans are listed in OAR 629-605-0170. Additionally plans for alternate practices may be required for any activity which proposes modification of a rule requirement such as normally retained riparian management area trees, conversion to a land use incompatible with tree cover or other situations listed in OAR 629-605-0173. Where other agencies' regulations will be applicable, written approval from those agencies must be submitted as part of the plan for alternate practice. Additionally, non-statutory written plans may be required for any situation encountered that is listed in OAR 629-605-0170. These requirements may be waived if a request is submitted to the local ODF Stewardship Forester and said request is deemed reasonable.

- Fire Protection – The Oregon Department of Forestry is responsible for wildfire protection on private, state and some federal lands (BLM west of Cascades). Individuals and corporations conducting forest operations are subject to wildfire prevention and suppression requirements under Oregon Revised Statute chapter 477 and the associated administrative rules within chapter 629. Additional information regarding these requirements is available at the Department's website, http://www.oregon.gov/odf/Pages/fire/fire.aspx.

    - **Power Driven Machinery (PDM) –** Every person conducting an operation within a forest protection district that uses fire in any form or power driven machinery shall first obtain from the forester a written permit (ORS 477.625). By obtaining a PDM, which is included in the Notification of Operation, operators are required to follow certain fire prevention, readiness and suppression guidelines during fire season.

- **Fire Season –** When fire season is declared those conducting an operation within a forest protection district must have fire tools and a water supply and also provide a watchman service. As fire danger increases through the course of the season, time restrictions may be imposed in an effort to prevent fires from starting during the most critical times of the day.
- **Liability –** Under Oregon law, a landowner/operator must make every reasonable effort to suppress a wildfire resulting from an operation. Part of this requirement stems from meeting the above requirements and following fire prevention laws and rules. Rules violations may result in the billing of the landowner for the costs required to put the fire out by ODF. Limited liability, with a cap of $300,000 in fire suppression costs, still occurs if the operator follows all of the rules.

- Road Construction and Reconstruction – Project operators must ensure that road construction, reconstruction, and maintenance comply with the Forest Practices Act rules and associated best management practices (Rule Division 625).

- Conversion of Forestlands – While nothing in the Forest Practices Act shall prevent the conversion of forestland to any other use (ORS 527.730), many of the implementing administrative rules address the conversion to non-forest use to ensure the conversion process is coordinated with other relevant federal, state, and local agencies.

- High Landslide Hazard Locations – Operations that include areas classified as high landslide hazard locations require planning and geotechnical assessment to provide for public safety (Rule Division 623).

<u>State Forest Lands</u> – Additional considerations beyond those noted above include project activities which could or will affect portions of state forests. The Northwest Oregon Forest Management Plan (FMP) directs and guides management activities on State Forest lands. The ODF concerns with respect to the referenced project(s) lie with the potential for hindrance in strategies employed to achieve FMP goals and objectives. Specific concerns and considerations include but are not necessarily limited to:

- **Loss of Timber Production –** Oregon law requires that state forest lands generate revenue for trust-land counties via timber sales. Loss of forest productivity is a concern particularly where land is converted to a non-forest status. To minimize the loss of productivity and conversion to a non-forest status, the ODF request that the operator(s) consider:
  - Keeping construction corridors to a minimum width and clear only what is necessary
  - Co-locate the pipeline in existing utility and road right-of-ways where possible
  - Provide for reforestation of the portion that will not be used as a permanent right of way
  - Consider alternative routes that avoid state forest land as much as possible

- Conflicts with Planned Operations – If and where appropriate, ODF requests that construction activity consider the timing of logging operations and mitigation that will minimize conflicts between road use, road construction, heavy equipment, log haul, and harvest activities. Additional activities such as tree planting, site preparation, and road maintenance should be considered as well.

- Terrain and Operational Constraints – Where planned project activity could or will challenge state forestland management interests such as general access, logging feasibility, timber sale design, slope stability, or resource inventory, coordination and consultation with ODF for project route selection are recommended and should be considered.

- Other Considerations – If and where appropriate considerations should be made where the proposed project(s) could or will affect FMP interests and or other applicable statute or rule as they relate to:
  - Protection of Forestland from wildfire
  - Aquatic and Riparian Resources
  - Threatened and Endangered Species
  - Land Management Classification System
  - Landscape Design
  - Recreation
  - Invasive Species
  - Cultural Resources

Oregon Department of Forestry appreciates the opportunity to comment on the proposed. In the event that additional questions or concerns arise please contact me at
503-945-7414.

Oregon Department of State Lands
Comment from Shawn P. Zumwalt, Land Manager, Eastern Region

Please accept the following response from the Oregon Department of State Lands (DSL) concerning the above. The DSL's comments are primarily related to the potential for construction of any new project(s) across state owned lands either within an existing easement or within a new easement area. Primary concerns include the following:

- Authorization
  - Each new use, even if added to any existing authorized structure(s), is deemed a separate and discrete use and requires authorization by DSL (OAR 141-122-020(8))
- Noxious weeds
  - Project would be required to ensure any new weed infestations would be addressed through project construction. DSL may potentially require wash stations or equipment be certified weed-free prior to working on State trust lands during the construction phase of the project. Long-term weed control would be a requirement within the easement area.

- Impacts to existing uses
  - Impacts to any existing authorized use would need to be minimized and/or require mitigation. Mitigation may require reseeding any areas impacted or disturbed.
  - If and where appropriate, DSL requests that construction activity consider any prior authorized activity and mitigation that will minimize conflicts with any prior authorized use. Additional activities such as tree planting, site preparation, reseeding, and road maintenance should be considered as well.
- Keep construction corridors to a minimum width and clear only what is necessary
- Co-locate the pipeline in existing utility and road right-of-ways where possible
- Provide for reforestation of the portion that will not be used as a permanent right of way
- Consider alternative routes that avoid state forest land as much as possible

In these instances project operators are responsible for review and compliance with applicable requirements found in statute and code. In addition, there is ongoing concern where proposed projects introduce the threat and or potential for creation of risk where wildfire is a concern.

Additionally, depending on the location of any proposed project activity, operator requirements and considerations may include but are not limited to the following conditions:

- **Other Considerations –** If and where appropriate considerations should be made where the proposed project(s) could or will affect State Land interests and or other applicable statute or rule as they relate to:
  - Protection of Forestland and Rangelands from wildfire
  - Aquatic and Riparian Resources
  - Threatened and Endangered Species
  - Land Management Classification System
  - Landscape Design
  - Recreation
  - Invasive Species
  - Cultural Resources

The Oregon Department of State Lands appreciates the opportunity to comment on the proposed. In the event that additional questions or concerns arise please contact me at
541-388-6033.

Oregon Department of Fish and Wildlife
Comments from Art Martin, Energy Coordinator, Wildlife Division

1) Are there new or updated geographic information system data, in addition to those indicated in Appendix A of the Workplan, which are publicly available, and which should be gathered:
   ODFW recommends utilization of our most recent GIS mapping and information delivery vehicle or decision support tool called Compass. Compass is the Oregon specific portal for the larger Crucial Habitat Assessment Tool (CHAT) decision support tool developed by the eleven western states and coordinated by the Western Governors Association (WGA).

ODFW Compass provides coarse-scale, non-regulatory fish and wildlife information, and contains a series of crucial habitat layers that emphasize areas documented as containing important natural resources. Compass can be found through the ODFW website, at http://www.dfw.state.or.us/maps/compass. Opening the Compass mapping application provides an interactive mapping system, with the ability to zoom and pan to a specific area within Oregon; turn data layers on and off; and adjust layer properties such as transparency. Once a dataset is turned on, many data layers provide additional information through clicking on a feature being displayed. The layer windows within Compass can also be adjusted (closed or minimized), providing additional space within a computer screen to set up a mapping project.

In addition to the mapping application, Compass web-pages also provide links to download GIS datasets, get more information through data documentation (metadata), and access supplementary online resources. The Compass Data page (http://www.dfw.state.or.us/maps/compass/data.asp) provides access to detailed documentation and metadata for the data layers within Compass, and links to download ODFW GIS datasets. The Compass Resources page http://www.dfw.state.or.us/maps/compass/resources.asp) provides links to other online mapping tools, such as Oregon Marine Map, ODFW Wildlife Viewing Map, The Wetland Restoration Planning Tool, and Oregon Explorer; as well as access to additional ODFW resources such as the Oregon Conservation Strategy. ODFW Compass was released in March, 2014 and is intended to be updated and improved on a regular basis. Users are encouraged to provide ODFW with any feedback, questions, comments, or suggestions by using the Compass Contacts page (http://www.dfw.state.or.us/maps/compass/contacts.asp).

2) Are there any laws, regulations, or other requirements that have been implemented since issuance of the DOI and FS RODs in January 2009 that the Agencies should consider when reviewing Corridors:
Additional Law/Regulation/Requirement: ODFW Fish and Wildlife Habitat Mitigation Policy

   Where it is located: http://www.dfw.state.or.us/OARs/415.pdf

   Relevance to Corridor Workplan or Regional Periodic Review: This policy is the primary framework for evaluating and categorizing the functional value of fish and wildlife habitat parcels which may be impacted through development actions. It also establishes standards and expectations for habitat mitigation and avoidance by habitat category in Oregon.

3) Are there any additional regional stakeholders that the Agencies should consider for stakeholder engagement during Regional Periodic Reviews?
Additional forum/stakeholder group: ODFW recommends the Agencies engage a comprehensive set of national, state, and local stakeholders such as, but not limited to:

- Industry Organizations such as AWEA, AWWI, Oregon Renewables Northwest, etc.
- State Agencies such as: ODFW, ODOE, ODF, ODA, ODSL, ODEQ, etc.
- County and local governments
- Conservation Organizations such as: The Nature Conservancy, Defenders of Wildlife, The National Wildlife Federation, The Theodore Roosevelt Conservation Partnership, The Portland Audubon Society, etc.

Oregon Department of Energy
Comments from Todd Cornett, Energy Siting Division Administrator

The Oregon Department of Energy Siting Division plays two distinctive roles with regards to energy infrastructure siting on federal lands. The first is related to facilities that are under both state and federal jurisdiction. The Governor-appointed Energy Facility Siting Council (EFSC) has jurisdiction over transmission lines and pipelines described in Oregon Revised Statute 469.300(11) on private, state as well as federal lands. An EFSC jurisdictional project on federal lands must therefore meet all of the applicable state requirements outlined in Oregon Revised Statute 469 and Oregon Administrative Rule 345. The EFSC siting process is a consolidated review that incorporates all applicable state, local and tribal requirements.

The second role is related to facilities under federal jurisdiction only. Siting staff serves to coordinate responses from all applicable state agencies to federal requests for input to ensure that applicants understand the importance of meeting all applicable state development requirements.

Tribes, and state and local agencies maintain inventories of identified resources and hazard areas that could be impacted based on the location of federal energy corridors. These include but are not limited to, natural resources, agricultural resources, forest resources, visual resources, cultural and historic resources and various hazards. These resources could be located within a proposed corridor, close enough to a corridor where there could be an indirect impact, or beyond the terminus of a corridor but where a project would be forced to be located for alignment reasons. It is therefore critical that these corridors are sited with these important state, local and tribal resources in mind, and consistent with the June 7, 2013 Presidential Memorandum, Transforming our Nation's Electric Grid through Improved Siting, Permitting, and Review.

> *"Energy corridors include areas on Federal lands that are most suitable for siting transmission projects because the chosen areas minimize regulatory conflicts and impacts on environmental and cultural resources, and also address concerns of local communities".*

A failure to take these important state, local and tribal resources into account when establishing federal energy corridors could result in a project that receives federal approval but that is denied by the state.

Consistent with Executive Order 13604, issued on March 22, 2012, it will be critical that federal agencies adopt policies and practices that incorporate early and active consultation with state, local and tribal governments to streamline applications processes within established corridors.

An early, well-coordinated effort, will avoid conflicts, duplication of effort and allow for concurrent rather than sequential reviews. We are committed to work collaboratively to ensure that all important state, local and tribal resources are protected.

JOHN A. KITZHABER, MD
Governor

May 22, 2014

Michael D. Nedd
Assistant Director
Energy, Minerals, and Realty Mgmt
Bureau of Land Management
US Dept. of the Interior

Tony L. Tooke
Associate Deputy Chief
National Forest System
US Forest Service
US Dept of Agriculture

Matt Rosenbaum
Acting Director
National Electricity Delivery
Office of Electricity Delivery
and Energy Reliability
US Dept of Energy

Re: Comments of the State of Oregon
Request for Information
West-Wide Energy Corridor Review

Dear Assistant Director Nedd, Associate Deputy Chief Tooke and Acting Director Rosenbaum:

The intersections of Section 368 corridors with state and privately-owned land are of critical importance. Oregon stands ready to be a strong partner in the development of transmission and pipeline infrastructure projects which cross federal lands. We look forward to early project collaboration to ensure all important state, local and tribal resources are protected.

State of Oregon natural resource agencies have reviewed the request for information for the West-Wide Energy Corridor Review. Detailed comments are attached to this letter.

Sincerely,

John A. Kitzhaber, M.D.
Governor

JAK:mh

254 STATE CAPITOL, SALEM OR 97301-4047 (503) 378-3111 FAX (503) 378-8970
WWW.OREGON.GOV

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

COMMENTS ON ENERGY CORRIDORS

2 messages

Evie Wilson Mon, Apr 21, 2014 at 4:00 PM
To: "368corridors@BLM.gov" <368corridors@blm.gov>

I'm responding to your request for comments regarding the West-Wide Energy Corridor Review. I'm requesting you extend the comment period on these energy corridors, covering eleven Western states, another 90 days. Sixty days is not enough to study this huge issue, and reach enough people. Please apply my extension request to both the BLM, FS and DoE comment sites. Thank you for providing this email address to make comments.

Note: For more information on energy corridors search for *West-Wide Energy Corridor Review*. There are two places to comment, one for the Dept. of Energy and one for the Forest Service.

Thank you, Evie Wilson

368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Tue, Apr 22, 2014 at 3:52 PM
To: Evie Wilson

Ms. Wilson,
Thank you for your recent feedback regarding the energy corridors request for information (RFI). We will take your comment into consideration and we look forward to receiving your feedback.

regards,
[Quoted text hidden]

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Public comments

2 messages

Dale Lewis To: 368corridors@blm.gov Sun, Mar 30, 2014 at 10:55 PM

To whom it may concern:

I am firmly in support of all development of the natural resources on public lands. Please drill for oil and natural gas, and mine for coal. I drive vehicles that run on diesel and gasoline/natural gas and I heat my home with propane. I believe only hypocrites support the limitation on drilling. Unless they NEVER fly on a plane, DRIVE a vehicle or use carbon based fuels to heat their homes... They are frauds!

I have traveled to China and they need to have limitation on the pollution.

Thank you,

Dale Lewis

Spring City, UT

368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Wed, Apr 2, 2014 at 1:27 PM
To:
Cc: Stephen Fusilier

Mr. Lewis,
Thank you for your recent feedback regarding the energy corridors request for information (RFI).

regards,

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Federal West-wide Energy Corridor Review Comments

1 message

Evie Wilson Wed, May 28, 2014 at 1:12 AM
To: "368corridors@blm.gov" <368corridors@blm.gov>

In response to your Workgroups request for comments, here are our comments:

We support upgrading oil and gas underground pipelines in the Energy Corridors, but are very much OPPOSED to putting "alternative" energy, wind and solar facilities, on public lands because:

1. They would supersede and destroy previously designated uses of public lands.
2. Solar energy facilities use large amounts of water, and water is scarce in desert areas.
3. The use of large amounts of water could be detrimental to existing wells.
4. These facilities use thousands of acres, negatively impact habitat and could kill eagles.
5. They would negatively impact private property, desert beauty and tourist values.
6. If they fail, the taxpayer would probably be left holding the bag, and the land would be ruined.

Please don't listen to the extremists who sued public agencies to focus on alternative energy. We hope you will only use the good points of their suggestions (bypass reserves), and NOT put large alternative energy facilities on public lands. In our opinion, that's a VERY BAD idea! The desert is a fragile environment, and those living there value its unique beauty. Please don't destroy it!

Yours truly, Wendy and Kevin Barry, 2684 East Westfall Rd., Mariposa CA 95338,

BISON CONNECT

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Please keep power lines away from national parks and wildlands -- Recommendations for West-wide Energy Corridors Review

2 messages

Chris Lish Sun, May 25, 2014 at 11:43 AM
Reply-To: Chris Lish
To: "368corridors@blm.gov" <368corridors@blm.gov>

Sunday, May 25, 2014

Michael D. Nedd,
Assistant Director, Energy, Minerals, and Realty Management
Bureau of Land Management
U.S. Department of the Interior.

Tony L. Tooke,
Associate Deputy Chief, National Forest System
U.S. Forest Service
U.S. Department of Agriculture.

Matt Rosenbaum,
Acting Director National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy.

Subject: Please keep power lines away from national parks and wildlands -- Recommendations for West-wide Energy Corridors Review

Dear Assistant Director Nedd, Associate Deputy Chief Tooke, and Acting Director Rosenbaum,

Thank you for your efforts to reevaluate the West-wide Energy Corridors. Currently, many corridors are proposed through sensitive wildlands including national monuments, proposed wilderness areas, and habitat for endangered species.

> *"As we peer into society's future, we—you and I, and our government—must avoid the impulse to live only for today, plundering for our own ease and convenience the precious resources of tomorrow. We cannot mortgage the material assets of our grandchildren without risking the loss also of their political and spiritual heritage. We want democracy to survive for all generations to come, not to become the insolvent phantom of tomorrow."*
> *-- Dwight D. Eisenhower*

I encourage you to take a thorough look as you reevaluate corridors and take steps necessary to avoid siting transmission lines and pipelines in wilderness-quality lands. Specifically, I encourage you to remove the corridor that runs adjacent to Arches National Park—large energy development in this area would mar the landscape and impact spectacular red rock vistas.

> *"Every man who appreciates the majesty and beauty of the wilderness and of wild life, should strike hands with the farsighted men who wish to preserve our material resources, in the effort to keep our forests and our game beasts, game-birds, and game-fish--indeed, all the living creatures of prairie and woodland and seashore--from wanton destruction. Above all, we should realize that the effort toward this end is essentially a democratic movement."*
> *-- Theodore Roosevelt*

At the same time, we need to find low-conflict places for future transmission lines. This is necessary to achieve a cleaner, safer energy future. Previous transmission plans favored coal and other fossil fuels, but now we have an opportunity to bring more wind, solar, and geothermal into the West's power grid than ever before and put our nation on a path towards a sustainable energy future. Please focus your efforts on areas that are important for renewable energy, such as the sunny desert Southwest, and lands that are already developed and close to metropolitan areas so that the energy lost through transmission will be reduced.

> *“A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”*
> *-- Aldo Leopold*

Thank you for your consideration of my comments. Please do NOT add my name to your mailing list. I will learn about future developments on this issue from other sources.

Sincerely,
Christopher Lish
Olema, CA

368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Tue, May 27, 2014 at 2:17 PM
To: Chris Lish

Mr. Lish,

Thank you for your recent feedback regarding the energy corridors request for information.

[Quoted text hidden]

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Federal Agency Corridors Webinar Follow-up

2 messages

Gil Hough Tue, May 27, 2014 at 5:50 PM
To: "368corridors@blm.gov" <368corridors@blm.gov>
Cc: Lesley Cusick , Steve Selecman

Restoration Services, Inc. (RSI) environmental professional Lesley Cusick participated in a webinar on the Federal Energy Corridors through her membership in the International Right of Way Association. Upon consultation with RSI's Renewable Energy Division manager, Gil Hough, we want to share a few thoughts on future potential expansion of the corridor approach to the Southeastern United States. Although the corridors are under consideration for the west at this time, we understand that expansion to other areas may be forthcoming. Further, RSI has experience on federal real property that may be of benefit to the overall effort.

- In the Southeast, the corridor approach will be very difficult to do in states with higher population and density. Federal properties are much more contained and fragmented than in the Western part of the nation.

- Electrical projects are only included in the present process if they can use higher than 100 kV lines; that threshold excludes a lot of good projects. The ability of the power line to handle the load is more important than an arbitrary voltage threshold. We suggest switching to something such as covering projects over 1 MW in size (The FERC threshold).

- We express strong support for regional Environmental Impact Studies; they reduce the soft cost of solar projects and take away a major barrier for development on federal lands for renewable energy projects.

- If land are designated lands for prime Renewable Energy use, it would be good to have them pre-packaged (i.e. the parcels close to grid access should be designated and made available for lease). The process to get control of such land needs to be completed in less than 6 months.

- Lease terms MUST be for 20 years or longer.

- If the lease rate is set at fair market value it must not be for fair market value for all potential uses, but Fair Market Value for land use in renewable energy development; which has a very small profit margin.

If you have any questions feel free to contact me.

lesley t. cusick | RSI | 865.297.4900 x119 office | 865.599.1805 cell

RSI

Restoration Services, Inc.

Earth Friendly • Project Savvy • Employee Owned

368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Mon, Jun 2, 2014 at 12:05 PM
To: Gil Hough <ghough@rsienv.com>

Mr. Hough and Ms. Cusick

Thank you for your recent feedback regarding the energy corridors request for information. We appreciate the information your have provided, and we will be taking it into consideration.

regards,

[Quoted text hidden]

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Request for Information: West-Wide Energy Corridor Review

2 messages

Jankowitz, Rachel J., DGF Fri, May 2, 2014 at 12:48 PM
To: "368corridors@blm.gov" <368corridors@blm.gov>

New sources of information:

NM Crucial Habitat Assessment Tool http://nmchat.org/

Southern Great Plains Habitat Assessment Tool (for Lesser Prairie-Chicken) http://kars.ku.edu/maps/sgpchat/

Playa Lakes Joint Venture Playa Decision Support Systerm http://www.pljv.org/playa-dss

-

Updated sources of information:

Biota Information System of NM http://www.bison-m.org/

Natural Heritage NM http://nhnm.unm.edu/index.php

Other comment: Consider adding CO2 pipeline to the type of project assessed for Section 368 corridors.

Rachel Jankowitz, Habitat Specialist

NM Department of Game & Fish

One Wildlife Way, P.O. Box 25112

Santa Fe NM 87504

(505) 476-8159

rjankowitz@state.nm.us

368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Mon, May 5, 2014 at 11:27 AM
To: "Jankowitz, Rachel J., DGF" <rachel.jankowitz@state.nm.us>

Rachel Jankowitz,

Thank you for your recent feedback regarding the energy corridors request for information (RFI). We appreciate the resources your have informed us of, and we will be taking them into consideration.

regards,
[Quoted text hidden]

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Fwd: Data to help with section 368 corridor analysis

2 messages

Fusilier, Stephen Fri, May 30, 2014 at 12:42 PM
To: Meredith Norton , BLM_WO 368corridors <368corridors@blm.gov>

FYI

Stephen L. Fusilier
Transmission and Energy Corridor Program Lead
20 M Street, SE
Washington, DC 20003
Phone – 202-912-7426
Cell - 202-309-3209
FAX - 202-912-7199

---------- Forwarded message ----------
From: **Marcia Rickey**
Date: Fri, May 30, 2014 at 12:08 PM
Subject: Data to help with section 368 corridor analysis
To: "sfusilie@blm.gov"
Cc: David Batts

Hi Stephen,

My name is Marcia Rickey, with EMPSi and I just wanted to introduce myself on the phone this morning and via email. I was a member of the core team for the BLM's Restoration Design Energy Project (RDEP) in Arizona. Kathy Pedrick at the AZSO was the BLM project manager. This project and associated analysis was recommended by Sonoran Institute's Ian Dowdy in Wednesday's EE News article "Obama admin retools sprawling Western 'energy corridor'". RDEP received great support from many stakeholders, including cooperating agencies, industry, and environmental groups, including a "CAPE" award from The Wilderness Society. In short, RDEP was an inclusive process that collected public and proprietary data (e.g., from regulatory agencies, organizations, and industry) to identify areas within Arizona that would have the least environmental constraints, and therefore serve as renewable energy development areas (REDAs). In addition to the data analysis, there was substantial coordination with cooperating agencies and stakeholders to help refine the REDAs and ensure that they fully met the purpose and need. In the end, RDEP amended 8 resource management plans in Arizona and identified over 190,000 acres are REDAs.

Myself and David Batts, EMPSi RDEP project manager, would be happy to discuss RDEP and how it may be helpful to the section 368 planning process. David is frequently at the BLM offices on M Street is available to meet with you if you wish.

The RDEP ROD is located http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/energy/rdep.Par.61787.File.dat/RDEP-ROD-ARMP.pdf, and GIS data published http://www.blm.gov/az/st/en/prog/maps/gis_files.html#rdep

Thanks, Marcia

Marcia Rickey

EMPSi Environmental Management and Planning Solutions, Inc.

3775 Iris Avenue, Suite 1A
Boulder, CO 80301
tel: 303-447-7160 fax: 866-625-0707

www.EMPSi.com Twitter: EMPSInc Facebook: EMPSi

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368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Fri, May 30, 2014 at 3:28 PM
To: "Fusilier, Stephen" <sfusilie@blm.gov>, david.batts@empsi.com, marcia.rickey@empsi.com
Cc: Meredith Norton <mcnorton@blm.gov>, BLM_WO 368corridors <368corridors@blm.gov>

Marcia,

Thank you for the input. We look forward to incorporating the information provided into our work. I would be glad to speak with David when he is in Washington sometime. Just have him give me an email or call to set up a visit.

Steve
[Quoted text hidden]

2014 Request for Information Public Input

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Re: West-Wide Energy Corridor Review

1 message

Fusilier, Stephen <sfusilie@blm.gov> Thu, Jul 3, 2014 at 7:09 AM
To: "Martin, Melissa P." , BLM_WO 368corridors <368corridors@blm.gov>

Melissa,

Currently we do not have any plans for public meetings in the near future. The Request for Information was published to solicit information regarding potential data sources we could use to inform a corridor study we plan to carry out this year and a series of regional reviews which are planned for the future, once funding is obtained.

The corridor study will be basically a data review - written records, reports, and GIS information, which will provide us with a foundation of what the current situation is regarding:
1. Which corridors are being used;
2. How they are being used;
3. Are any not being used and if so why not:
4. Have any reached their use capacity or are nearing it;
5. Are there any restrictions such as endangered species habitat that restrict the use of particular corridors;
6. and similar questions to these that can be provided by the data sources that are available.

Once the foundational corridor study is complete and funding is obtained we will begin regional reviews (one at a time based on regions we or currently dividing the corridor areas in the west into) which will which will entail public outreach including possibly public meetings (the methods and types of outreach will be dependent on the amount of funding provided in the budget for the reviews). These regional reviews will be more in-depth then the corridor study and will be used to inform us regarding potential future corridor needs, potential conflicts, areas where corridors might need to be revised, removed or added, and other information that might come out in the review.

We will be glad to keep you informed as to future activity. We have request funding to at least begin the first regional review in FY 2015 but will not know if funding will be available until Congress passes and the President signs a budget.

Stephen L. Fusilier
Transmission and Energy Corridor Program Lead
20 M Street, SE
Washington, DC 20003
Phone – 202-912-7426
Cell - 202-309-3209
FAX - 202-912-7199

On Wed, Jul 2, 2014 at 6:34 PM, Martin, Melissa P. wrote:

> Mr. Fusilier,
>
> Good evening. I work for Stateside Associates and monitor the federal register. You were listed as the contact for West-Wide Energy Corridor Review and I was hoping to find out if you expect any public meetings to be held. I would appreciate any general updates. If you have a separate list serv please add my name and email. '
>
> I appreciate your help and time.
>
> http://www.gpo.gov/fdsys/pkg/FR-2014-03-28/html/2014-06945.htm
>
> Sincerely,

Melissa Martin
Stateside Associates
703-525-7466 ext 237

May 27, 2014

Response to Request for Information, 79 FR 60 (3/28/2014)

Robert Cunningham, Principal, Pathway Consulting Service, LLC

Judith Lee, President, Environmental Planning Strategies, Inc.

Mail response to: sfusilie@blm.gov

Michael D. Nedd,

Assistant Director, Energy, Minerals, and Realty Management, Bureau of Land Management, U.S. Department of the Interior.

Tony L. Tooke,

Associate Deputy Chief, National Forest System, U.S. Forest Service, U.S. Department of Agriculture.

Matt Rosenbaum,

Acting Director National Electricity Delivery, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy.

Introduction

Thank you for the opportunity to comment on the West-wide 368 Energy Corridor Review. Robert Cunningham, Principal of Pathway Consulting Service, LLC, and Judith Lee, President of Environmental Planning Strategies, Inc. are submitting the following comments jointly. Our comments are based on many years of practical experience in the preparation and environmental review of federal land use authorizations and the management of complex projects involving the use of federal land.

Bob, as Assistant and Acting Director of Land and Realty Management for the USDA Forest Service's national office, served as the Forest Service (FS) representative to the three-member inter-agency team managing the West-wide 368 Energy Corridor Project and its Environmental Impact Statement (EIS). The Final EIS supported the decisions to amend FS and Bureau of Land Management (BLM) land use plans to designate Energy Corridors in 11 Western States. Bob also served as the USDA representative the scenario-planning group for the Western Electricity Coordinating Council (WECC) and the successful settlement negotiations of the 368 Corridor litigation concluded in July 2012.

Overarching Comments on Project Planning and Role the 368 Corridors Play

The designation of energy corridors crossing multiple units of federal land is an important step toward improving the siting and operation of energy transmission infrastructure. Improved coordination among federal agencies and the systematic review of projects and progress reporting will prove beneficial. These measures will hopefully enhance managerial engagement and staff involvement within the agencies, particularly the BLM and FS.

Much of the delay and uncertainty in using federal land rests on a failure to properly engage interests early in project planning and the failure to appropriately integrate and tailor project requirements. Our comments address how the 368 corridors can be used to improve the early engagement of the proponent, government administrators, and interested publics. In addition, we point out how the sound planning principles of early engagement and integration of requirements can improve project development, operation, and eventual removal of a project from federal land.

The 368 Corridors are a Useful and Important Tool

- The 368 Corridors are a major contribution toward avoiding a proliferation of energy transmission corridors crossing federal land directed by Congress in the Forest Land Policy and Management Act (FLPMA) of 1976. The 368 Corridors focus the siting of linear projects within areas identified by the BLM and FS as potentially suitable for such use, with a reduced likelihood of potential adverse impacts on resources and fewer constraints on land uses than would be found on other federal lands;
- Creating feasible land use corridors that cross federal agency jurisdictional boundaries sharing common termini are a useful tool for increasing the efficiency of the inter- and intra-agency planning of energy-related transmission projects;
- Identifying mandatory programmatic mitigation measures (interagency operating procedures; IOPs), as applicable, improves consistency in protecting resources and maintaining future options for land use, while focusing opportunities for both site-specific and regional/landscape compensatory mitigation;
- The 368 Corridors encourage the efficient planning and effective implementation of needed energy projects; and
- Use of the 368 Corridors can improve the communication among project proponents and agency planners and decisionmakers, enabling them to more efficiently conduct environmental reviews under the National Environmental Policy Act (NEPA), project planning, and agency land use authorization and regulatory permitting. These actions will make good projects better, promptly revise or terminate unnecessary or inappropriate projects, and

complete timely project permitting necessary for improving the nation's electricity grid and delivery of energy resources.

The 368 Corridors are an Important Element of Project Planning by Proponent/Applicants and Agencies

With the above in mind, we also want to emphasize that use of the 368 Corridors, similar to considerations of landscape-level compensatory mitigation, is simply an element of project planning and permitting that should be considered early and throughout project development. For example, the following should be considered during project planning:

- Project proponents, prior to initiating a pre-application process or submitting a formal land use application to the responsible federal agency, should investigate and evaluate opportunities for using a 368 Corridor for their project;
- Project proponents and potential lead, cooperating, and participating federal and state agencies should further investigate the suitability of these 368 Corridors during the pre-application process; and
- Project applicants (former proponents are applicants once an application is accepted for formal review by the lead agency) and identified lead, cooperating, and participating agencies should continue evaluation of the 368 Corridors as part of planning, concurrent NEPA analyses, and integrated regulatory and agency permitting. Amendment, addition, or deletion of a 368 Corridor should be thoughtfully considered when evaluating a specific request to site a project within one or more of the 368 Corridors as they are currently configured in agency land use plans.

Delays in Federal Response to Applications Have Many Causes

In addition to findings in Executive Orders and Memoranda, we observe that federal agencies at the operating levels are slow to initiate and conduct necessary work on proponents' projects during the pre-application and application phases of project development. This lack of response or "slow rolling" is likely due to:

- Lack of human resources, funds (especially during the pre-application process), and committed leadership available to re-assign staff from already planned, funded, and required duties;
- Lack of positive organizational recognition for efficient and effective work on requests to use federal land. Conversely, lack of any organizational or managerial penalties for not responding or constantly delaying a legitimate request to use federal land for energy transmission. Managerial impacts are high and penalties severe for mistakes or poorly managed controversy occurring during consideration of complex land use permits.

- Lack of accepting responsibility for inherently governmental functions by agency managers and decisionmakers. Responsible officials often delegate or defer to contractors the project planning, NEPA analyses and compliance, public and agency involvement, and permitting without their appropriate direct involvement, administrative decisionmaking, and oversight; and
- Resistance to engage and manage the frequent public conflict created by publicly responding to and conducting necessary planning, regulatory compliance, and permitting of large linear projects crossing federal lands.

Training of Participants in Use of 368 Corridors is Necessary

Training of all parties in the use and benefits of the 368 corridors is a must. Don't short-change the effort. Training of federal employees in issues pertinent to a land use application is a legitimate charge to a cost recovery account. Fund and apply it as a part of a planning permit.

NEPA Must be Recognized as a Critical Support of Effective Project Planning and Scheduling, Not an Obstacle

It is critical that the federal government recognize that NEPA is a fundamental element of quality project planning and complex projects require time and resources to plan and permit correctly. NEPA does not start after a project is already in the late planning stages. NEPA is an element of project planning that begins long before a public notice is issued. If it is useful to keep track of the time invested in permitting the use of federal land, keep track of the how long it takes to request and approve a land use permit. NEPA is only an element in that equation. A key element in the schedule is the committed time that federal agencies respond and implement all planning and permitting requirements, including the pre-application and pre-Notice of Intent activities necessary for initiating the overall planning effort efficiently and effectively. As we stated in our introduction to these comments, a primary problem in the timeliness of responding to an application, including during the pre-application period, is the lack of federal engagement, timely funding, and resources during the entire planning period, not NEPA itself. Also, the effectiveness and completeness of the planning conducted by the proponent before and during the pre-application process is also critical to proper and timely federal response and action.

Additional Comments

The 368 Corridors are to intended to and, we believe, do provide positive contributions to improving the efficiency and effectiveness of federal agency response to proponent (applicant) proposed linear projects as well as increased certainty for proponents (applicants). We offer the following comments to the request for information:

Are there any new or updated data that are publicly available?

The WECC has conducted an in-depth review of existing regional and national data sets and their usefulness. The users manual may be found at:
http://www.wecc.biz/committees/BOD/TEPPC/SPSG/EDTF/Shared%20Documents/Environmental_Recommendations_for_Transmission_Planning/Final_Recommendations_Report/EDTF_Data_Sets_Users_Manual.pdf

The EISPC may also be useful for areas in the eastern US.

The EPA provides access to its extensive datasets, many of which have been made very user-friendly through the portal: http://www.epa.gov/datafinder/. This portal also has a link to datasets supported by other agencies, such as NOAA, USDA, DOI, and USGS that may be helpful.

Are there any other types of projects that the agencies should consider to assess use of Section 368 Corridors?

Lengthy linear projects such as broadband and telecommunication infrastructure could use the 368 corridors across federal land. It is possible that a limited few highway and railway projects could consider 368 corridors, as these are more localized with fewer direct options for siting.

Always, however, the application of sound planning principles within the 368 Corridors can and should be applied for other projects. The planning principles of early engagement of project interests and the integration and tailoring of project requirements through well-managed cause and effect analyses will improve all projects requiring the use of federal land.

Are there methods the agencies should consider using to evaluate the effectiveness of the IOPs?

The 368 Corridor Interagency Operating Procedures (IOPs) are mandatory for use. Yet, the introduction for listing the IOPs in Appendix C of the Corridor Study Work Plan wisely states that each requirement is to be applied, as appropriate, when and where it makes sense to do so. This simple statement captures the essence of integrating and tailoring project requirements to fit the on-the-ground, factual circumstances of each project. Unfortunately, in practice it is easier said than done. Often, governmental agencies and stakeholders formulate lists of project requirements addressing physical, biological, or social parameters – requirements to ensure their interests are met. Lists grow as attention to a project increases. The project planners and government managers are handed the daunting task of reconciling a growing list of requirements while still meeting the need for the project in practical and cost-effective ways. It is critical that IOPs be applied only as needed to address resource mitigation needs specific to impacts potentially generated by the project.

An assessment of the effectiveness of the IOPs can be made from reviewing the project requirements stated in the land use authorizations and project permits and by monitoring their application and effectiveness. If the project planning is truly integrated and IOP requirements applied to actual on-the-ground circumstances, the IOPs will appear only when and where they are needed. You would not expect to see a requirement for a silt fence crossing a hilltop. A detailed review of two or three 368 Corridor projects by a small team would provide a reasonable assessment of the usefulness of the IOPs in supporting successful projects and addressing environmental issues.

Also, comparing the number of project proposals requesting to use 368 Corridors crossing BLM and FS land over a year with proposals for similarly scaled projects that do not elect to site within a designated 368 Corridor would be helpful. This review should help determine if project proponents may be avoiding a 368 Corridor because of the IOPs or if the 368 Corridors are in an undesirable location. It is also possible that proponents and agencies are not sufficiently familiar with or are reluctant to use the 368 corridors.

Continue the reporting required in the study plan and make the results available on-line.

Are there any laws, regulations, or other requirements that have been implemented since issuance of the DOI and FS RODs in January 2009 that the Agencies should consider when reviewing Section 368 Corridors?

The US Army Corps of Engineers has issues an updated list of its nationwide permits, which it is required to do every 5 years.

Identification of additional stakeholders. Are there any additional regional stakeholder fora that the Agencies should consider for stakeholder engagement during Regional Periodic Reviews?

The Western Regional Partnership, and Sonora Institute may wish to participate.

Are there any additions, deletions, or revisions the Agencies should consider making to the IOPs that were adopted in the DOI and FS RODs, and what is the rationale for those changes?

The IOPs are listed by resource area and do not appear coordinated relative to process versus performance criteria. Several are process requirements repeated for each discipline listed. Grouping process-requirements and then addressing resource areas as they relate to one another could improve all IOPs by demonstrating an integration of requirements to be applied where and when they are needed.

An integrated evaluation of issues in factual, on-the-ground cause-and-effect analyses would provide the information needed to understand which IOPs are needed for a specific project and where and under what circumstances each should be applied. The list of mitigation requirements should point to an integrated understanding of the measures necessary to reduce the environmental impact of a project. The multi-disciplinary list of requirements, resource area by resource area as now presented does not point to the integration of requirements and tailoring their application in the real problem solving encountered in siting a linear facility crossing multiple administrative units and ecological environments.

Emphasizing the use of a Planning Permit issued by the lead federal agency to engage agencies in the development of a complete SF 299 application would encourage government personnel and applicants to appropriately consider the use of 368 corridors for siting linear infrastructure. Many agencies cannot obtain cost recovery funds needed for engagement of federal personnel until an application for land use is accepted for evaluation by the lead agency. By issuing a planning permit, the project proponent, now an applicant, can engage and fund the agency personnel needed to complete a well-reasoned and detailed application for land use. The planning permit would enable the applicant to perform non-invasive site investigations and further refine the proposal to use and occupy federal land in close cooperation with the applicable federal agency.

Some units of the federal government inappropriately do not allow an applicant to participate in the development of an environmental review as called for in a few of the IOPs. It needs to be clarified that an applicant can and should be available to supply needed technical information to the agency and or third party NEPA contractor during environmental review, permitting, and the preparation of the resulting environmental document. Such participation can take place without compromising the inherently governmental functions as stated in 40 CFR 1506.5 and OMB's *Policy Letter 11-01 to the Heads of Executive Departments and Agencies 09/12/2011.*

Comments on New IOPs. The Agencies have committed to consideration of new IOPs submitted by the Plaintiffs who are parties to the Settlement. The new IOPs are available at http://corridoreis.anl.gov. Are there any comments on these new IOPs?

After regrouping the IOPs as suggested above, clearly state that the IOPs are to be applied where and when they are needed as determined through an integrated evaluation of project requirements in factual on-the-ground cause and effect analyses. The statement should make it clear that the analyses must be undertaken by an interdisciplinary team properly supervised by agency managers with the organizational resources necessary to complete their work in a timely manner.

We suggest the following IOP:

The IOPs are mandatory and intended to be applied as specific requirements of land use authorizations where and when they are needed to reduce or otherwise mitigate the effects of project construction, operation, and eventual removal as determined by the responsible official through site-specific project evaluation and monitoring of results.

May 27, 2014

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Via: 368corridors@blm.gov

Re: Recommendations Related to the Request for Information: West-wide Energy Corridor Review

Dear Mr. Nedd, Mr. Tooke, Mr. Rosenbaum, and Mr. Fusilier:

On behalf of a subgroup of the Arizona Solar Working Group (ASWG), the Sonoran Institute submits the following comments in response to the *Request for Information: West-wide Energy Corridor Review,* published by the U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS) in the ***Federal Register*** on March 28, 2014.

The ASWG[1] was assembled to promote dialogue and collaboration between conservation and wildlife organizations, renewable energy advocates, utilities, and solar developers working towards a sustainable energy future. ASWG members signing on to these comments include the Arizona Game and Fish Department, Defenders of Wildlife, Sonoran Institute, The Wilderness Society, First Solar and Abengoa Solar. The ASWG believes it is important to look holistically

[1] Organizations participating in the Arizona Solar Working Group include: Abengoa, Arizona Public Service, Arizona Wildlife Federation, Defenders of Wildlife, First Solar, Ibedrola Renewables, Salt River Project, Sierra Club, Solar Energy Industry Assocation, Sonoran Institute, The Wilderness Society, Tucson Electric Power, and Vote Solar.

when developing generation and transmission projects to ensure that they are planned and built to avoid and minimize impacts on the state's magnificent lands and wildlife.

This letter provides comments and information to the BLM and USFS as they engage in the ongoing process to revise, remove, and add West-wide Energy Corridors (WWEC), as directed by Section 368 of the Energy Policy Act of 2005 and pursuant to a 2012 Settlement Agreement.[2] We are supportive of the re-evaluation and revision process that we hope will better avoid environmentally sensitive areas, diminish proliferation of dispersed right-of-ways (ROWs), and facilitate development of renewable energy projects. This work is also consistent with the June 7, 2013 *Presidential Memorandum: Transforming our Nation's Electric Grid Through Improved Siting, Permitting, and Review*, which calls on federal agencies to promote the development of energy right-of-way corridors with a special focus on developing renewable energy resources while minimizing impacts on environmental and cultural resources and developing interagency mitigation plans.

We believe our working group, and these comments, are a model of a transparent, collaborative, stakeholder-driven review and assessment processes that will help ensure that diverse, low-conflict corridors are available to facilitate the development of transmission infrastructure to deliver renewable power to markets while preserving our wildlife and natural resource heritage.

1. Identification of Priority Regions

We understand that the BLM and USFS will be identifying one or more priority regions for the first WWEC re-evaluation effort which is currently underway. We recommend that western Arizona be included as a priority region because it is home to important Sonoran Desert wild lands and wildlife habitat that should be protected and it is a crucial region for renewable energy and transmission development.

Over the past decade in the West, substantial planning efforts have been undertaken to assess environmental risk from infrastructure development and to identify the highest quality, lowest impact, and easiest to access development areas for renewable energy and/or transmission.[3] This work stems from the recognition that renewable sources of power will be increasingly developed and that there are more and less suitable places for large-scale generation projects and associated transmission. By identifying these places in advance, projects can be guided to lower-conflict places on the landscape, increasing predictability for development and conservation alike.

Arizona has been a state leader in this regard. The Arizona BLM office undertook a statewide assessment, the Restoration Design Energy Project (RDEP), that identified 196,000 acres of low-conflict BLM lands suitable for solar and wind development. This assessment also identified USFS, state trust, and private lands that met similar criteria. The Arizona State Land Department undertook a similar assessment of state trust lands that identified lands suitable for renewable

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[2]The Settlement Agreement resulted in the dismissal of the case *The Wilderness Society, et al. v. United States Department of the Interior, et al., No. 3:09-cv-03048-JW (N.D. Cal.)*.

[3] These include the Western Governors' Association's Western Renewable Energy Zone identification process, BLM's Solar Programmatic Environmental Impact Statement, the Western Electricity Coordinating Council's Environmental Data Task Force, and California's Desert Renewable Energy Conservation Plan.

energy development. Finally, Arizona counties and other local jurisdictions are identifying Renewable Energy Incentive Districts where they would like to see future solar and wind development. Many of the lands identified as suitable for solar and wind development via these various processes are areas west of the Phoenix metropolitan area.

Additionally, Arizona's political and economic development leadership is building the state's economic future, in part, on solar energy development. The state's abundant solar resources, among the best in world, and vast land base are the assets being touted to generate economic activity in job creation, tax revenues, and capital investment. Arizona is expected to consume an increasing amount of solar in-state,[4] but recognizes that export is necessary and desirable to increase the state's economic prosperity. As transmission lines are the highways of electricity, the state must be able to build future transmission infrastructure to deliver its primary energy product—solar electricity—to markets throughout the West.

- While the pace and magnitude of development is uncertain, market fundamentals dictate that additional transmission and transfer capability likely will be needed in Arizona and between Arizona and other states.

- Arizona's growth rate—historically one of the nation's highest—requires continual investment in transmission infrastructure to reach newly developed areas and to ensure reliability of the existing system as it expands.

- Arizona's western neighbor is the world's seventh largest economy, the nation's largest state energy consumer, and the state with the most aggressive clean energy goals.

- Arizona's eastern neighbor has high-quality wind resources that far exceed projected in-state demand and will seek to export these.

- Arizona is home to two of the largest electric hubs in the West (Palo Verde Hub and Four Corners) demonstrating the significant past investment in major transmission infrastructure. These areas will continue to be important centers for transmission that will need to be expanded and modernized.

As the region undergoes change in its traditional energy mix and increases reliance on wind and solar generation, it becomes more important to access diverse resources from around the west to ensure reliability and to lower the cost for integrating variable resources.

***Recommendation*: The factors described above indicate a strong likelihood that additional transmission, and possibly new corridors, will be needed in Arizona in the future. The BLM and USFS should include Arizona as a priority region as part of the WWEC re-evaluation.**

2. Assessment of Existing and Potential Future WWEC

[4] Arizona's historic load growth is 4% per year, much faster than the national average of 1.5%.

a. Justification for WWEC including how they may facilitate renewable energy development

The WWEC re-evaluation is designed to ensure that WWEC designations "provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission."

Given the technological, market, and policy changes that have occurred in the energy sector since the existing WWEC were designated, it is unclear whether any of these WWEC meet this important criteria. New analyses, reports, and plans have been developed that seek to determine where there may be a need for additional transmission capacity to facilitate renewable energy development. These sources of information should be reviewed by the BLM and USFS while reviewing existing WWEC and considering potential new WWEC.

Moreover, ongoing developments underscore that the electric energy industry is in a great deal of flux. These developments include:

- **Retirement of coal plants.** Due to evolving federal regulations concerning federal pollution and health standards, as well as economic reasons, there is a trend toward the planned retirement or closure of coal plants. Development of new generation sources will be required to meet consumer usage demands and this may affect operation of the current transmission system.

- **Expanding Use of Natural Gas**. Recent technology changes have increased the amount of natural gas available in this country resulting in some utilities expanding their planned use of natural gas for power generation.

- **Expanded development of solar and other renewable energy sources.** Clean energy development is being driven by a number of factors: states have renewable energy procurement requirements (Arizona - 15% by 2025, California - 33% by 2020, Colorado - 30% by 2020, Nevada - 25% by 2025, and New Mexico - 20% by 2020); renewable energy costs have been decreasing significantly; utilities are planning for control of carbon dioxide pollution; utilities have been adopting and integrating renewables such as solar into their generation mix; and rooftop solar generation has been embraced by consumers and are becoming more popular.

- **Greater control of electrical usage.** Energy efficiency, demand response, smart meter and advanced control systems, often referred to as smart grid initiatives, allow individuals and utilities to shape their load and demand.

- **Growing use of electric and plug-in hybrid electric vehicles.** Electrification of the transportation sector creates a new load source that will likely impact electricity resources through increased demand and possible shifts in demand cycles.

- **Increased use of distributed generation.** Micro grids, residential and commercial photovoltaic systems, and on-site generation technology requires investment in distribution infrastructure. Electric vehicles or plug-in hybrids may also provide a source of storage, akin to distributed generation, if used to feed electricity back into the grid during peak demand hours.

- **More frequent and extensive cooperation among electric entities in the West.** Among utilities, the changing generation mix has created interest in sharing reserves and energy imbalances to smooth variability of renewable energy generation. This will likely require that utilities build new systems to share resources to better plan and more easily cooperate across service areas and state lines.

- **The emergence of merchant/independent transmission developers.** New federal regulations[5] also allow private (merchant and independent) transmission developers, who do not have a specific customer base, to compete to build transmission. A merchant/independent transmission developer's job is to build transmission to an economically justifiable location that may serve a number of energy developers and providers, including utilities. The merchant/independent developer approach introduces a further element of uncertainty about how future transmission will be developed and location of possible lines.

While some trends may indicate a reduced need for transmission corridors, other trends point to the increased importance of a strong transmission system. No matter which trend prevails, there will be changes to the use of the existing transmission system. Conflicting trends also strongly illustrate the uncertainty of future sources of electricity, usage demands, grid reliability, and the need to preserve options, as increased regional sharing and increased development of Arizona's solar resources may require additional transmission development.

Given the uncertainties in forecasting transmission needs, the BLM and USFS should clarify the key assumptions and justifications for existing WWEC and those that will drive future WWEC designations. As directed in the Settlement Agreement (**Attachment 1**), this includes how WWEC may facilitate renewable energy development. The corridor siting principles detailed in the Settlement Agreement dictate that the BLM and USFS will consider how "Corridors provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission." (Settlement Agreement p. 6) These assumptions and justifications are particularly important for "Corridors of Concern" identified in the Settlement Agreement as potentially facilitating additional coal-fired electricity production, but they should be developed for all WWEC.[6] This may be accomplished through preparation of various development scenarios and determining commonalities within these scenarios that serve

[5] Federal Energy Regulatory Commission Order 1000.
[6] "Corridors of Concern" were identified by the plaintiffs in *The Wilderness Society, et al. v. United States Department of the Interior, et al., No. 3:09-cv-03048-JW (N.D. Cal.)* as having specific environmental issues. As part of the Settlement Agreement, the BLM and the FS committed to re-evaluating the "Corridors of Concern" as part of the period review process. The list of "Corridors of Concern" and specific environmental issues was included in Exhibit A to the Settlement Agreement, attached to this letter as **Attachment 2**.

as overall driving assumptions behind corridor designations. This is essentially the approach taken by the Western Electricity Coordinating Council (WECC) in development of their 10- and 20-year regional transmission plans.

***Recommendation*: The BLM and USFS should develop a clear set of overarching assumptions and justifications for existing WWEC and those that will drive future WWEC designations, including how WWEC may facilitate renewable energy development, with a particular focus on "Corridors of Concern" identified as potentially facilitating additional coal-fired electricity production. Both agencies should consider using a scenario planning process similar to the one developed by WECC or partner with WECC in subsequent updates to their regional transmission plans.**

b. Justification of individual WWEC designations

There is also a need for the BLM and USFS to provide additional information regarding the assumptions and justification behind individual WWEC designations. Similarly, these should address how transmission development in individual corridors will facilitate renewable energy development. There have been numerous studies in Arizona that have assessed the need for additional transmission capacity, including biennial transmission assessments, some which discuss how to increase Arizona's export capability to markets in California.[7]

Additionally, the BLM and USFS should consult more closely with utilities regarding their transmission planning priorities. Recent discussions with utility members of ASWG underscores that current designated corridors are not perceived to meet their needs. Also, it should be noted that the two "merchant" lines undergoing environmental assessments under NEPA—SunZia and Southline—chose not to use WWECs as their preferred routes. As to what factors may be contributing to their lack of use, that will require additional analyses. These may include trends described in section 2(a) of our comments.

***Recommendation*: The BLM and USFS should develop a clear set of assumptions and justifications specific to each individual WWEC designation. These should be based in part on consultations with utilities, renewable energy developers, and merchant line developers.**

c. Recommended data sources to identify future transmission needs

A number of transmission and renewable energy planning and forecasting efforts have been conducted since the WWEC Record of Decision (ROD) was signed in January 2009. These data sources should be considered by the BLM and USFS as they re-evaluate the existing WWEC and consider potential future WWEC:

- Solar Programmatic Environmental Impact Statement – The Solar PEIS was prepared by the U.S. Department of Energy, Energy Efficiency and Renewable Energy Program and the U.S. Department of the Interior, Bureau of Land Management (the Agencies) in order to assess environmental impacts associated with the development and implementation of agency-

[7] For example, see *Seventh Biennial Transmission Assessment (2012-2021 Staff Report*, Arizona Corporation Commission Docket No. E-00000D-11-0017, December 12, 2012.

specific programs that would facilitate environmentally responsible utility-scale solar energy development in six western states (Arizona, California, Colorado, New Mexico, Nevada, and Utah) http://solareis.anl.gov.

- Restoration Design Energy Project (RDEP) – RDEP is a BLM Arizona initiative to identify lands across the State that may be suitable for the development of renewable energy. *It* establishes 192,100 acres of renewable energy development areas on BLM land throughout Arizona. http://www.blm.gov/az/st/en/prog/energy/arra_solar.html.

- Regional Transmission Expansion Plan (RTEP) – The Western Electricity Coordinating Council (WECC creates biennial 10-year plans and a 20-year Interconnection-wide transmission plans that are guided by stakeholder-created scenarios and informed by environmental analysis. These plans are designed to inform a wide range of stakeholders on potential impacts to reliability and assist in meeting policy mandates. http://www.wecc.biz/committees/BOD/TEPPC/Pages/RTEP.aspx.

- Renewable Electricity Futures Study - The National Renewable Energy Laboratory's study is an initial investigation of the extent to which renewable energy supply can meet the electricity demands of the continental United States over the next several decades. This study explores the implications and challenges of very high renewable electricity generation levels—from 30% up to 90%, focusing on 80%, of all U.S. electricity generation—in 2050. http://www.nrel.gov/analysis/re_futures.

- Arizona Renewable Resource and Transmission Identification Subcommittee (ARRTIS) – This subcommittee to the Renewable Transmission Task Force of the Southwest Area Transmission Planning group, surveyed renewable resource and environmental sensitivity data to identify areas within the state where solar and wind resources were technically ideal for utility-scale generation development and the location of environmentally sensitivity areas, that should be excluded from consideration for generation facilities. http://www.westconnect.com/filestorage/ARRTIS%20Final%20Report.pdf.

- Arizona utility biennial transmission plans – These reports, which are prepared by regulated utilities on behalf of the Arizona Corporation Commission (ACC), outline their transmission project priorities for a 10-year period. Based on these plans, the ACC issues a written decision on the adequacy of the existing and planned transmission facilities to meet the present and future needs of state. http://www.azcc.gov/divisions/utilities/electric/biennial.asp.

- Arizona Renewable Energy Mapping Project – Led by the Arizona Land Department, this is a collaborative project to create a renewable energy mapping system to help facilitate the development of Arizona's renewable energy resources in a coordinated manner. It is designed to help users evaluate lands for their general potential for development as renewable energy generation sites, and provides information regarding specific areas which are currently under consideration for development. http://renewablemap.az.gov/portal/node/5.

d. Recommended approach to environmental assessment of WWEC

As detailed in the Settlement Agreement, the BLM and USFS are required to improve their approach to completing environmental assessments of the WWEC to better avoid environmentally sensitive areas. Arizona BLM used an approach to screening potential wind and solar development lands in RDEP that should be used as a model for screening the WWEC. RDEP did not identify or designate priority “Renewable Energy Development Areas” in locations that conflicted with the screens. Though the RDEP screens were developed in consideration of wind and solar development, most of the screens are also appropriate in consideration of large-scale transmission development (100 kV or greater) contemplated for the WWEC. If WWEC conflict with the screens, the BLM should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict. The screens used for RDEP are included as **Attachment 3**.

The landscape-scale assessment used in RDEP is consistent with several BLM initiatives including the BLM’s Western Solar Energy Program and BLM’s Rapid Ecoregional Assessments. It is also consistent with BLM guidance directing a landscape-scale or regional approach to planning for and mitigating energy development in the agency’s Draft Regional Mitigation Manual. Overall, a more comprehensive approach to planning for and mitigating renewable energy and transmission development is needed to limit and off-set impacts while supporting responsible development.

Beyond the landscape-scale assessment using the RDEP screens, the BLM and USFS should also complete a more detailed analysis of the WWEC using site-specific data. ASWG has conducted an initial risk analysis of potential impacts to regionally important wildlife habitat and species, using data supplied by the Arizona Game and Fish Department (AZGFD) and the US Fish and Wildlife Service (USFWS). Our methods and results are described in greater detail in **Appendix A**. Using publicly available datasets such as species distribution models, critical habitat, intact habitat blocks, and wildlife linkage corridors, we have provided an overview of the types of species and habitats most at risk from potential corridor development in the region. While direct habitat loss and fragmentation is the most noticeable impact of transmission development on wildlife, other impacts, while more difficult to quantify, are of equal or greater importance for wildlife, and these impacts vary greatly among species (see **Appendix B** for more detail on the effects of transmission development on desert wildlife species).

The BLM and USFS should use federal and state agency data, including Rapid Ecoregional Assessments, US Geological Survey (USGS) research and modeling, the AZGFD Heritage Data Management System, and other models and tools to develop their own predictive models that synthesize quantitative field data using an objective modeling process to estimate risk to a wide variety of Special Status Species and ecoregions from the various impacts of transmission development. AZGFD has just this year developed several state-scale models of landscape integrity and connectivity, which are not yet in public release but which the BLM and USFS may be able to use to inform WWEC re-evaluation via state consultation. The BLM and USFS should pursue this avenue to ensure that it uses the best-available science in corridor planning and decision-making.

Finally, the results of modelling should be used to inform management at all steps in the mitigation hierarchy. Overall we recommend the BLM and USFS consult with the USFWS and AZGFD to interpret the best available information from BLM, AZFGD, and USGS models, which should inform screening potential WWEC for conflicts with important low density, habitat connectivity and dispersal habitats for special status species. If WWEC conflict with the habitat screens, the BLM and USFS should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict.

Sources for recommendations for minimization and compensatory measures include:

- 2007-2008 region-specific Linkage Design Reports developed by the AZGFD and Northern Arizona University and available at http://corridordesign.org/linkages/arizona. Consult with AZGFD for additional information on linkage design, landscape integrity, and statewide connectivity.
- AZ BLM (2012), "Desert Tortoise Mitigation Policy." Available at http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/efoia/2012IM_IB.Par.65054.File.dat/IMAZ-2012-031.pdf.
- The Avian Power Line Interaction Committee's "Suggested Practices for Avian Protection on Power Lines" available at: http://www.aplic.org/uploads/files/2643/SuggestedPractices2006(LR-2).pdf;
- Avian Power Line Interaction Committee (APLIC). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012.* Edison Electric Institute and APLIC. Washington, D.C. Available at: http://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf.
- Edison Electric Institute's "Mitigating Bird Collisions with Power Lines" available at: http://www2.eei.org/products_and_services/descriptions_and_access/mitigating_birds.htm
- Western Resource Advocates' "Smart Lines" report, available at: http://www.westernresourceadvocates.org/energy/smartlines.php; and
- Wild Utah Project's "Best Management Practices for Siting, Developing, Operating and Monitoring Renewable Energy in the Intermountain West" available at: http://wildutahproject.org/files/images/BMP%20for%20Renewable%20Energy-2012-WUP.pdf

***Recommendations:* The BLM and USFS should use the RDEP screens to conduct a landscape-scale assessment of the WWEC. Similarly, the BLM and USFS should also screen for all important low density, habitat connectivity and dispersal habitats for special status species. If WWEC conflict with the RDEP and/or habitat screens, the BLM and USFS should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict.**

e. Environmental assessment of non-federal lands WWEC may traverse

The Western Electricity Coordinating Council hosted three meetings with transmission developers in the fall of 2013 to solicit feedback on potential transmission corridors, including WWECs. Meeting participants reached no consensus regarding the WWEC, noting that these corridors "often end at high-risk lands – not continuous from federal to private lands, which diminishes their usefulness." Participants also added that the WWEC "often still contain sensitive environmental and cultural resources that are identified at the siting level." While these comments elucidate the views of a small group of transmission developers, they likely underscore the need for the BLM and USFS to engage transmission developers more effectively in the identification of potential WWEC and conduct more thorough environmental assessments of potential WWEC.

For existing WWEC to be truly viable there must be a reasonable basis to assume that all segments of the WWEC, including portions not on federal lands, avoid environmentally sensitive areas to the maximum extent practicable. While the BLM and USFS do not have the authority to designate WWEC on non-federal lands, they do have the capacity to extend environmental assessments to non-federal lands. The RDEP planning process conducted by the Arizona BLM serves an important precedent and example of how such an assessment can be extended to non-federal lands.

***Recommendation*: The BLM and USFS should extend its environmental assessment of existing corridors to non-federal lands, including private and state trust lands.**

f. Example WWEC justification and environmental assessment – corridor 30-52

The WWECs require additional site-specific analysis to assure stakeholders, applicants, and the agencies that corridors truly represent viable, relatively low-conflict places to develop transmission across the landscape. ASWG has chosen one corridor, WWEC 30-52 in southwestern Arizona, to provide an example of the type of assessment that corridors should undergo to ensure viability.

ASWG believes that the portion of WWEC 30-52 in Arizona offers an important opportunity to facilitate renewable energy development in Arizona for a number of reasons. First, studies and plans have underscored that the lack of transmission capacity is an issue in terms of facilitating transmission of energy between Arizona and California, in this case, the Blythe-area collection of substations.[8] Second, the corridor's proximity to both Solar Energy Zones and Renewable Energy Development Areas on BLM lands would allow it to accommodate future transmission lines that would deliver solar power developed on those BLM lands to markets in Arizona and California. Third, the corridor would provide access to the Palo Verde hub, which is accessible to renewable energy developers.

[8] Conflicts with 30-52 are likely to occur around the San Gorgonio Pass northwest of Palm Springs, CA, where infrastructure is already substantially built out in a narrow area. We expect that the BLM will consider southern California corridors, including the western portion of 30-52, as part of the ongoing CA Desert Renewable Energy Conservation Plan process, and will incorporate the results of this process into its assessment of relevant Arizona corridors as well.

A detailed environmental assessment of WWEC 30-52 also reveals potential for wildlife conflict, which corridor revision must take into account such that it avoids and minimizes impacts, and where necessary and appropriate, requires compensatory mitigation. WWEC 30-52, which roughly parallels Interstate 10 in southwestern Arizona, encompasses 62 linear miles of public lands. Within a two-mile wide corridor along that length, the corridor encounters substantial overlap with modeled suitability habitat for Western burrowing owl, Sonoran desert tortoise, Golden eagle, Gila monster, Lowland leopard frog, Sprague's pipit, Yuma clapper rail, California leaf-nosed bat, Desert bighorn sheep, and Kit fox (see **Appendix B** for additional information regarding how we conducted our analysis, as well as maps and detailed results).

Segment 30-52 also crosses a number of wildlife movement areas (yellow, green, and blue on the map in Figure 3 of **Appendix A**), identified by AZGFD and a collaborative stakeholder group in 2006. It is important to maintain connectivity for wildlife in these areas, as described above in section 2d. Much of 30-52 is in La Paz County, where AZGFD has worked with county stakeholders to conduct a detailed linkage assessment in priority areas. AZGFD and county stakeholders are likely to have information on key connectivity resources to avoid, best management and construction practices (such as minimizing line spacing or using existing infrastructure) to minimize impacts in these areas, and opportunities for compensatory mitigation where necessary and appropriate.

While 30-52 does not appear to cross any designated critical habitat in Arizona, it does at its Colorado River crossing and care must be taken there to ensure avoidance of adverse modification to the critical habitat.

Additional concerns with 30-52 that should be addressed as part of the assessment of non-federal lands include the following:

- Colorado River Indian Community: It appears that this corridor will have to traverse this Native American community. There should be significant outreach and government to government communication about the possible harms and concerns that may occur as a result of this infrastructure.

- Some of the lands north of the I-10 are designated floodplains and should be evaluated for value as habitat in this arid environment.

- La Paz County has raised some concerns about development of renewable energy and its detrimental impact to limited public services. Conversations should occur with County officials to determine mutually beneficial approaches to resolving this issue.

- The exact location of a transmission line within the corridor is unknown; placement of the physical infrastructure should be as close as possible to the Interstate to limit the expansion of environmental impacts.

***Recommendation*: The BLM and USFS should prioritize analysis of WWEC 30-52 based on the justification provided that it could be a helpful corridor for renewables; analysis of the**

corridor should be oriented towards identifying and resolving the conflicts described above via corridor re-routing and identifying appropriate minimization and mitigation measures.

g. Recommended additional data sources for environmental assessment of WWEC

In addition to the data sources included in the WWEC Programmatic Environmental Impact Statement and the data detailed in section 2.b. of these comments, the BLM and USFS should also use the following data sources as they conduct environmental assessments of potential new WWEC:

- Updates to Arizona Game and Fish Department's (AZGFD) HabiMap data: HabiMap makes data and information included in AZGFD's State Wildlife Action Plan easily accessible. Website: http://www.habimap.org/ Contact: Richard Lawrence, RLawrence@azgfd.gov.

- Revised and/or amended BLM Resource Management Plans (RMPs): BLM has recently revised or amended several RMPs in Arizona, including the Lower Sonoran/Sonoran Desert National Monument RMPs. Updated data and land management information from these RMPs should be evaluated.

- Citizens' Proposed Wilderness data: These lands have been inventoried by citizens groups, conservationists, and agencies and have been found to have "wilderness characteristics," including naturalness, solitude, and the opportunity for primitive recreation. Contact: Alex Daue, The Wilderness Society, alex_daue@tws.org, (303) 650-5818, ext.108.

- Sonoran Desert Heritage Conservation Proposal: Contact, Ian Dowdy, Sonoran Institute, idowdy@sonoraninstitute.org, (602) 393-4310, ext.308.

h. Engagement in other planning efforts

A number of transmission and other infrastructure planning efforts are ongoing or are commencing that offer opportunities to coordinate or integrate WWEC planning. Among them are:

- Town of Gila Bend Transmission Feasibility Study – The Town of Gila Bend is currently engaged in a transmission planning effort to identify new corridors that will facilitate renewable energy development in the community and allow for export of that power to markets in and outside of Arizona. This effort appears to align with the goals of WWEC.

- Interstate 11 Study: High level planning has been occurring over the past two years by the Arizona and Nevada departments of transportation to identify potential routes for the proposed new interstate highway between Phoenix and Las Vegas. Both departments are considering opportunities to coordinate planning for transmission lines along these routes.

- Renewable Energy Development Zones – Jurisdictions, including the Town of Gila Bend and Yuma, Pima, and Maricopa counties, have identified areas where they wish to encourage renewable energy development. La Paz is considering embarking on a similar strategy. Additional transmission capacity may be needed to allow development to occur in these areas.

***Recommendation*: The BLM and USFS should more proactively engage in these and other planning efforts to determine whether there are opportunities to coordinate or integrate WWEC planning.**

i. Stakeholder engagement

With regard to stakeholder engagement, we offer the following considerations. First, planning for energy transmission corridors is both complex and will likely impact a broad range of landscapes and communities in multiple ways. Conventional public engagement processes like those required under NEPA provide for meaningful public input but may not be adequate to address long-distance corridors. Additional engagement strategies should be considered by the BLM and USFS. ASWG offers one such model. While ASWG is led by a non-governmental organization (the Sonoran Institute), the group's work is done in a transparent fashion, with key federal and state agencies continually apprised of the group's activities and invited to participate in the group's discussions. The ASWG would welcome the opportunity to host a listening session on the WWEC re-evaluation and invite BLM and USFS staff from Arizona and Washington D.C. to participate.

Second, ASWG's collective experience is that the BLM and USFS could do a better job proactively reaching out to state agencies and local governments. In Arizona, key state agencies to engage include: the Governor's Office, Arizona State Land Department, Arizona Game and Fish Department, Arizona Department of Transportation, and the Arizona Corporation Commission's Line Siting Committee. At the local level, county commissioners and planning departments should be engaged.

***Recommendation*: The BLM and USFS should more proactively engage state agencies and local governments. Both agencies also should consider engagement strategies that go beyond those required under NEPA and that provide multiple stakeholders with additional opportunities for input. These complementary strategies could be led by non-governmental organizations or other entities. BLM and USFS staff from Arizona and Washington D.C. should participate in a listening session on the West-wide Energy Corridors hosted by the ASWG.**

3. Improvements to Interagency Operating Procedures

As part of the Settlement Agreement, the BLM and USFS also committed to review their existing Interagency Operating Procedures (IOPs), including their utility, pertinent new data, and suggestions from stakeholders for changes to the IOPs. IOPs identify required management procedures that would be incorporated into project-specific energy transport development proposals. The IOPs were incorporated into the land use plan amendments conducted as part of the WWEC PEIS ROD. The BLM and USFS also committed to considering new IOPs for specific resources including, but not limited to, wildlife, wilderness characteristics and special areas.

The Solar PEIS included "Design Features" that were intended to achieve the same outcomes as the IOPs – avoiding, minimizing, and/or mitigating the potential adverse effects of solar energy development. While the Design Features were developed to address solar energy development, most of them are applicable for transmission development in WWEC as well. The value of the Solar PEIS Design Features lies in their level of detail and specificity with regard to procedures and resources, the addition of which would greatly strengthen the WWEC IOPs. We recommend that the BLM and USFS incorporate the Design Features from the Solar PEIS into the WWEC as IOPs. The Solar PEIS Design Features are included in the Solar PEIS Record of Decision, available at: http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf

a. Specially Designated Areas and Lands with Wilderness Characteristics

For example, the Solar PEIS Design Features for Specially Designated Areas and Lands with Wilderness Characteristics (two of the specific resources identified in the Settlement Agreement for consideration of improved IOPs) should be incorporated as IOPs (Solar PEIS ROD pp. 54-56 – note that the lettering "A.4.1.2" comes directly from the Solar PEIS ROD and is not intended to follow the outline letter of this comment letter):

> **A.4.1.2 Design Features for Specially Designated Areas and Lands with Wilderness Characteristics**
> The following design features have been identified to avoid, minimize, and/or mitigate potential impacts on specially designated areas and lands with wilderness characteristics from solar energy development identified and discussed in Sections 5.3.1 and 5.3.2 of the Draft and Final Solar PEIS.
>
> ***A.4.1.2.1 General***
>
> **LWC1-1** Protection of existing values of specially designated areas and lands with wilderness characteristics shall be evaluated during the environmental analysis for solar energy projects, and the results shall be incorporated into the project planning and design.
>
> (a) Assessing potential impacts on specially designated areas and lands with wilderness characteristics shall include, but is not limited to, the following:
>
> • Identifying specially designated areas and lands with wilderness characteristics in proximity to the proposed projects. In coordination with the BLM, developers shall consult existing land use plans and updated inventories.
> • Identifying lands that are within the geographic scope of a proposed solar project that have not been recently inventoried for wilderness characteristics or any lands that have been identified in a citizen's wilderness proposal in order to determine whether they possess wilderness characteristics. Developers shall consider including the wilderness

characteristics evaluation as part of the processing of a solar energy ROW application for those lands without a recent wilderness characteristics inventory. All work must be completed in accordance with current BLM policies and procedures.
• Evaluating impacts on specially designated areas and lands with wilderness characteristics as part of the environmental impact analysis for the project and considering options to avoid, minimize, and/or mitigate adverse impacts in coordination with the BLM.

(b) Methods to mitigate unavoidable impacts on specially designated areas and lands with wilderness characteristics may include, but are not limited to, the following:

• Acquiring wilderness inholdings from willing sellers.
• Acquiring private lands from willing sellers adjacent to designated wilderness.
• Acquiring private lands from willing sellers within proposed wilderness or Wilderness Study Areas.
• Acquiring other lands containing important wilderness or related values, such as opportunities for solitude or a primitive, unconfined (type of) recreation.
• Restoring wilderness, for example, modifying routes or other structures that detract from wilderness character.
• Contributing mitigation monies to a "wilderness mitigation bank," if one exists, to fund activities such as the ones described above.
• Enacting management to protect lands with wilderness characteristics in the same field office or region that are not currently being managed to protect wilderness character. Areas that are to be managed to protect wilderness characteristics under this approach must be of sufficient size to be manageable, which could also include areas adjacent to current WSAs or adjacent to areas currently being managed to protect wilderness characteristics.

A A.4.1.2.2 Site Characterization, Siting and Design, Construction

LWC2-1 Solar facilities shall be sited, designed, and constructed to avoid, minimize, and/or mitigate impacts on the values of specially designated areas and lands with wilderness characteristics.[9]

b. Ecological Resources

Another example of Solar PEIS Design Features that should be included as IOPs are those for **Ecological Resources**, in particular for wildlife (which was also identified in the settlement agreement for consideration of improved IOPs) (Solar PEIS ROD pp74-89). While the section is too long to reproduce in its entirety here, we recommend that the BLM incorporate its measures into the Corridor Review process. We note the value in particular of specific guidance on compliance with wildlife-related regulations in the early phases of project planning including:

- The Endangered Species Act,
- the Bald and Golden Eagle Act,

[9] See Section 4.3 of the Final Solar PEIS for details on areas included in these categories.

- the Migratory Bird Treaty Act,
- identification of sensitive ecological resources,
- considering restrictions on timing and duration of activities, etc.

It is also particularly important to provide clear guidance on techniques for impact avoidance and minimization, including:

- limiting the number of stream crossings,
- conducting nesting bird surveys,
- siting and designing projects away from habitats occupied by Special Status Species,[10]
- placing tall structures to avoid known flight paths of birds and bats,
- implementing guidelines to minimize raptor and bird collision and electrocution hazard,
- marking transmission lines,
- designing line support structures and other facilities to discourage perching and nesting,
- spanning important or sensitive habitats with long lines,
- and other key design, construction, operations, and decommissioning techniques.

In addition to general Design Features applicable to all utility-scale solar development on BLM lands, the Solar PEIS also designated Design Features specific to each of the Solar Energy Zones designated through the PEIS (see, http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf). The BLM and the USFS should also create specific IOPs for individual WWEC or segments of WWEC that are most likely to be developed to address specific resource issues there.

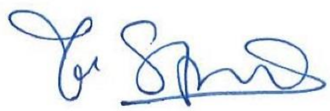
Recommendation: ***The BLM and USFS should incorporate the Design Features from the Solar PEIS as IOPs, including the Design Features for Specially Designated Areas and Lands with Wilderness Characteristics and Ecological Resources. The BLM and USFS should also create specific IOPs for individual WWEC or segments of WWEC that are most likely to be developed to address specific resource issues there.***

We appreciate the opportunity to comment, and look forward to following up with you to answer any questions you have and provide additional details if requested.

On Behalf of the Arizona Solar Working Group,

Sincerely,

[10] As described in the Solar PEIS ROD (p74), "Special status species include the following types of species: (1) species listed as threatened or endangered under the ESA; (2) species that are proposed for listing, under review, or candidates for listing under the ESA; (3) species that are listed as threatened or endangered by the state or are identified as fully protected by the state; (4) species that are listed by the BLM as sensitive; and (5) species that have been ranked S1 or S2 by the state or as species of concern by the state or USFWS. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840. These species are included here to ensure broad consideration of species that may be most vulnerable to impacts."



John Shepard
Co-Interim Chief Executive Officer
Sonoran Institute

CC: Ray Suazo, Arizona BLM State Director
Rapid Response Transmission Team
Lucas Lucero, BLM WO

Attachments and appendices:

- Attachment 1: West-wide Energy Corridors Settlement Agreement
- Attachment 2: Exhibit A to Settlement Agreement – Corridors of Concern
- Attachment 3: Restoration Design Energy Project Screens
- Appendix A: Mapping Discussion and Results
- Appendix B: Effects of Transmission Development on Desert Wildlife Species

Note: Full-scale electronic maps in PDF Binder form (24x24" high-resolution printable/ zoomable pages) can be accessed at:

https://defendersofwildlife.exavault.com/share/view/3km6-91gfx7s8.
Note that this link will expire on June 30th, 2014.

Attachment 1

SETTLEMENT AGREEMENT

Plaintiffs The Wilderness Society, BARK, Center for Biological Diversity, Defenders of Wildlife, Great Old Broads for Wilderness, Klamath-Siskiyou Wildlands Center, National Parks Conservation Association, National Trust for Historic Preservation, Natural Resources Defense Council, Oregon Natural Desert Association, Sierra Club, Southern Utah Wilderness Alliance, Western Resource Advocates, Western Watersheds Project, and County of San Miguel, Colorado ("Plaintiffs"), and Federal Defendants United States Department of the Interior ("DOI"), Kenneth L. Salazar, Secretary of the Interior; United States Bureau of Land Management ("BLM"); Robert Abbey, Director, BLM; United States Department of Agriculture; Tom Vilsack, Secretary of Agriculture; United States Forest Service ("FS"); Tom Tidwell, Chief of the Forest Service; United States Department of Energy ("DOE"); and Steven Chu, Secretary of Energy ("Defendants") (collectively the "Parties"), by and through their undersigned counsel, hereby agree and stipulate as follows:

WHEREAS, on July 7, 2009, Plaintiffs filed the Complaint in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.), which Plaintiffs amended on September 14, 2009;

WHEREAS Plaintiffs' Amended Complaint alleges violations of the Energy Policy Act of 2005, P.L. 109-58 ("EPAct"), the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq*. ("NEPA"), the Federal Land Policy and Management Act, 43 U.S.C. § 1763 *et seq*. ("FLPMA"), the Endangered Species Act, 16 U.S.C. § 1531 *et seq.* ("ESA"), and the Administrative Procedure Act, 5 U.S.C. § 551 *et seq*. ("APA");

WHEREAS Section 368 of the EPAct, 42 U.S.C. § 15926(a), directs the Secretaries of Agriculture, Commerce, Defense, Energy, and Interior, in consultation with the Federal Energy Regulatory Commission, States, tribal or local units of government as appropriate, affected utility industries, and other interested persons, to designate corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land, beginning with 11 western States ("section 368 Corridors");

WHEREAS Section 368 of the EPAct further directs the Secretaries of Agriculture, Commerce, Defense, Energy, and Interior to "perform any environmental reviews required to complete the designation" of the corridors and to formalize the designations by "incorporat[ing] the designated corridors into the relevant agency land use and resource management plans or equivalent plans," 42 U.S.C. §§ 15926(a)(2) and 3;

WHEREAS, on November 20, 2008, Defendants issued a Final Programmatic Environmental Impact Statement for the section 368 Corridors, 73 Fed. Reg. 72,521 (Nov. 28, 2008);

WHEREAS, on January 14, 2009, the Deputy Assistant Secretary, Land and Minerals Management, signed a Record of Decision, amending 92 BLM land use plans to incorporate designation of the Section 368 Corridors;

WHEREAS, on January 14, 2009, the Undersecretary of the Department of Agriculture signed a Record of Decision amending 38 National Forest Land Management plans to incorporate designation of the Section 368 Corridors;

WHEREAS the Parties wish to implement this Settlement Agreement to resolve Plaintiffs' Amended Complaint in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.), and thereby avoid protracted and costly litigation and preserve judicial resources;

WHEREAS the Parties have agreed to a settlement of these matters without any adjudication or admission of fact or law by any party; and

WHEREAS the Parties believe that this Agreement is in the public interest;

the Parties now agree as follows:

I. SCOPE OF AGREEMENT

A. This Agreement shall constitute a complete and final settlement of Plaintiffs' Amended Complaint in *The Wilderness Society, et al. v. United States Department of Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.).

B. This Agreement in no way affects the rights of the United States as against any person not a party hereto.

C. Nothing in this Agreement shall constitute an admission of fact or law by any party. This Agreement shall not be used or admitted in any proceeding against a party over the objection of that party.

D. This Settlement Agreement constitutes the final, complete, and exclusive agreement and understanding between the Parties and supersedes all prior agreements and understandings, whether oral or written, concerning the subject matter hereof. No other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Settlement Agreement or the settlement it represents, nor shall it be used in construing this Settlement Agreement. It is further expressly understood and agreed that this Agreement was jointly drafted by the Parties. Accordingly, the Parties agree that any and all rules of construction to the effect that ambiguity is construed against the drafting party shall be inapplicable in any dispute concerning the terms or interpretation of this Agreement.

E. This Agreement shall be governed by and construed under federal law.

F. Nothing in this Settlement Agreement shall constitute, or be construed to constitute, a waiver of sovereign immunity by the United States. Nothing in the terms of this Agreement shall be construed to limit or modify the discretion accorded Defendants by the APA, the EPAct, NEPA, FLPMA, the ESA, or by general principles of administrative law.

G. The Parties agree that Defendants' obligations under this Settlement Agreement are contingent upon the availability of appropriated funds and that nothing contained in this Settlement Agreement shall be construed as a commitment or requirement that Defendants obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. §1341, or other applicable law.

II. SPECIFIC PROVISIONS

A. This Agreement consists of the following five provisions: an interagency Memorandum of Understanding ("MOU") addressing periodic corridor reviews; agency guidance; training; corridor study; and IM 2010-169. The objectives of these settlement provisions are to ensure that future revision, deletion, or addition to the system of corridors designated pursuant to section 368 of EPAct consider the following general principles: location of corridors in favorable land-scapes, facilitation of renewable energy projects where feasible, avoidance of environmentally sensitive areas to the maximum extent practicable, diminution of the proliferation of dispersed rights-of-way ("ROWs") crossing the landscape, and improvement of the long-term benefits of reliable and safe energy transmission. In addition, revisions, deletions, or additions to section 368 corridors are to be made through an open and transparent process incorporating consultation and robust opportunities for engagement by tribes, states, local governments, and other interested parties.

1. Interagency MOU: The BLM, FS, and DOE (the "Agencies") will periodically review the section 368 corridors, as provided in Section 1.a.-c. below, on a regional basis to assess the need for corridor revisions, deletions, or additions. The agencies will establish an MOU describing the interagency process for conducting these reviews, the types of information and data to be considered, and the process for incorporating resulting recommendations in BLM and FS land use plans. DOE's role will be limited to providing technical assistance in the areas of transmission adequacy and electric power system operation, as needed. As part of the periodic review process, the BLM and the FS will re-evaluate those corridors identified by plaintiffs as having specific environmental issues, attached as Exhibit A.[1] The BLM and the FS

[1] Corridors of Concern: The corridors identified by plaintiffs are referred to here as "corridors of concern."

will also concurrently review their existing Interagency Operating Procedures ("IOPs") to identify any revisions, deletions, and additions necessary.

These items will comprise the elements of an interagency MOU to establish a process for periodic review of section 368 corridors and the IOPs.

a. Interagency Workgroup:

- The agencies will establish an interagency workgroup composed of national office and field personnel, as appropriate.
- The workgroup will identify new relevant information (below at b.) that is pertinent to the consideration of section 368 corridors.
- The workgroup shall examine this new relevant information, review the corridors based on this information, and develop recommendations for any revisions, deletions, or additions to the section 368 corridors.
- The BLM and the FS shall ensure that recommendations are conveyed to appropriate agency managers and staff and that these recommendations are fully considered, as appropriate under applicable law, regulations, and agency policy and guidance.
- The BLM and the FS shall ensure that the siting principles (below at c.) are fully considered and public, tribal, and governmental involvement commitments (below at f.) are fully met.

b. Review materials: The new relevant information that the workgroup will review includes, but is not limited to:

- Results of the joint studies of electric transmission needs and renewable energy potential currently being conducted by the Western Electricity Coordinating Council ("WECC") and the Western Governors' Association ("WGA"), and funded by the DOE;
- Results of BLM's eco-regional assessments that characterize the ecological values across regional landscapes;

- Agency Corridor Study of current use of section 368 corridors and IOPs (below at Section 4.);
- Other on-going resource studies, such as the WGA wildlife corridor study, the BLM's National Sage-Grouse Habitat Conservation Strategy, and the State of Wyoming's sage grouse strategy; and
- Current studies and other factors, such as states' renewable portfolio standards, that address potential demand, source, and load with particular regard to renewable energy.

c. Corridor Siting Principles: The Agencies shall review the following areas to ensure that the general principles listed here were considered in siting the current corridors, especially with regard to efficient use of the landscape: (i) northeastern California and northwestern Nevada, (ii) southern California, southeastern Nevada, and western Utah, and (iii) southern Wyoming, northeastern Utah, and northwestern Colorado. The BLM and the FS will make future recommendations for revisions, deletions, and additions to the section 368 corridor network consistent with applicable law, regulations, agency policy and guidance, and will also consider the following general principles in future siting recommendations:

- Corridors are thoughtfully sited to provide maximum utility and minimum impact to the environment;
- Corridors promote efficient use of the landscape for necessary development;
- Appropriate and acceptable uses are defined for specific corridors; and
- Corridors provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission.

d. **Interagency Operating Procedures:** The BLM and the FS shall review the IOPs adopted in their respective Records of Decision designating energy corridors (January 2009). The BLM and the FS shall review the current utility of the IOPs and pertinent new data and shall actively solicit suggestions from stake-holders for changes to the IOPs. The BLM and FS shall consider new IOPs submitted by Plaintiffs for specific resources including, but not limited to, wildlife, wilderness characteristics, and special areas. The BLM and the FS shall develop recommendations for updating the IOPs concurrently with their periodic review of section 368 corridors.

e. **Implementation of Workgroup Recommendations:** Workgroup recommendations for section 368 corridor revisions, deletions, or additions will be considered for implementation through the BLM and the FS land use planning and environmental review processes. There are three circumstances when such consideration may occur:

- During the normal course of land use plan(s) revisions;
- During an amendment to a land use plan(s) caused by a specific project proposal that does not conform to a land use plan, or when issues within a designated section 368 corridor necessitate review of an alternative corridor path; or
- During an amendment to individual land use plans specifically to address corridor changes.

BLM and FS will adopt recommended changes to the IOPs (additions, revisions, deletions) through internal guidance or manuals or handbooks.

f. **Stakeholder Participation:** There will be two significant opportunities for stakeholder participation:

- The workgroup will provide information to and solicit comment from the public regarding its periodic review of corridors and consequent recommendations, and also engage in consultation with other federal agencies, tribes, states, local governments, and other interested persons through an active exchange of information and opinion during review and before the workgroup makes a recommendation(s). Workgroup members will use this same process in their periodic review of BLM and FS IOPs and recommendations therefor. The MOU will outline appropriate means for conducting outreach, which may include listening sessions/information sharing, web postings/comments, or other appropriate means.

- Any land use plan amendments that consider workgroup recommendations will require evaluation under NEPA in accordance with applicable law, regulations, and agency policy and guidance. The agencies agree to a robust public involvement process and will ensure that:
  - The NEPA process follows agency procedures, including all applicable opportunities for stakeholder, tribal, state, and local government participation;
  - All potentially interested parties are provided opportunities to participate in scoping and the environmental review process as required by agency procedures;
  - Opportunities for full involvement of minority populations, low-income communities, and tribes are promoted and provided by the agencies.

g. Agency Responsibilities:

- BLM, FS, and DOE will each identify an official responsible for implementation of this settlement agreement.
- The DOE shall provide technical review, advice, and assistance regarding:
  - The need for proposed energy transport facilities;
  - The practical functionality of section 368 corridors;

  - o The impact on reliability and electric system operation for facilities located outside section 368 corridors; and
  - o Other technical factors relevant to siting energy transport facilities.
- The BLM and the FS will make recommendations for revisions, deletions, and additions to section 368 corridors and ensure that these recommendations are considered, consistent with applicable law, regulations, agency policy and guidance, and this Agreement.

h. Working Group Duration: The interagency workgroup will convene upon signing the MOU and remain in effect until any of its participating agencies determines that the workgroup no longer serves a purpose, but no less than two years following the signing of the MOU. The workgroup shall provide a brief annual report to each agency's MOU signatory, assessing the effectiveness of the workgroup, progress on the settlement agreement commitments, and the current utility of the group. The report will be made available to the public along with a summary of any revisions, deletions, or additions to the section 368 corridors completed at that time.

2. Agency Guidance: The BLM and the FS agree to issue internal guidance to managers and staff regarding use and development of the section 368 corridors. As part of this guidance, the agencies will provide direction on using corridors of concern and will identify known conflicts within these corridors. The BLM and the FS will also issue direction, consistent with applicable NEPA regulations, on how to use the Final Programmatic Environmental Impact Statement ("FPEIS"), *Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386)*, when preparing site-specific NEPA documents.

The BLM and the FS shall develop coordinated guidance for agency managers regarding use of section 368 corridors, and the guidance shall include the following elements:

a. Corridor Use: BLM and FS managers will: encourage project proponents to locate projects within designated corridors or adjacent to existing rights-of-way; notify project proponents of any section 368 corridor segments that are corridors of concern; and consider alternative locations if a proposed project would be located within a section 368 corridor of concern segment. The agencies recognize that siting projects within corridors will require site-specific environmental analysis, as well as review of land use plans, as required by applicable law, regulations, and agency policy and guidance.

b. Corridors of Concern: BLM and FS managers will be notified of those corridors of concern set forth by the plaintiffs at Exhibit A and the concerns identified there. Managers and the public will be notified that siting projects within these corridors will likely lead to heightened public interest and concern and may:

- Be challenged;
- Involve significant environmental impacts;
- Involve substantially increased or extensive mitigation measures such as off-site mitigation to compensate for impacts to sensitive resources;
- Include preparation of an environmental impact statement;
- Include consideration of alternatives outside the corridor and consideration of an alternative that denies the requested use; and
- Include amendment of the applicable land use plan to modify or delete the corridor of concern and designate an alternative corridor.

c. Use of the FPEIS:

- BLM and FS will be reminded that site-specific projects in a section 368 corridor will require individual NEPA analysis. The scope of that NEPA review will include analysis of whether the use of that corridor identified in the FPEIS is appropriate in the context of the site-specific project and/or whether additional analysis should be undertaken to modify or delete the corridor and designate an alternative corridor.

- BLM and FS will encourage "incorporation by reference" of data and studies in the FPEIS and other relevant documents, as appropriate for individual projects and consistent with NEPA regulations, in order to reduce bulky and redundant studies.
- BLM and FS managers will be directed that tiering to the FPEIS is not a substitute for site-specific analyses of any project proposed within a section 368 corridor and that environmental reviews of projects within section 368 corridors are subject to this settlement agreement and the NEPA regulations at 40 C.F.R. § 1502.20 and 40 C.F.R. § 1508.28.

d. Implementation of IOPs: Guidance will include:

- Procedures for periodic review and update of IOPs, based on the principles of adaptive management and including stakeholder engagement;
- Use of IOPs outside designated corridors on Federal lands; and
- Adoption of IOPs considered and approved by the agencies, particularly with reference to wilderness characteristics, wildlife, and special areas.

e. Corridor Changes: Guidance will remind managers that revisions, deletions, and additions to section 368 corridors must (at a minimum) meet the requirements specified for these corridors in section 368 of the EPAct and must consider the siting principles identified in section 1.c. above.

3. Training: The BLM and the FS agree to incorporate environmental concerns into agency training regarding the processing of applications for pipeline and electricity transmission ROWs, and to invite participation from representatives of environmental groups, tribes, and industry in such courses. The BLM and the FS agree to review existing training materials and incorporate an increased emphasis on environmental considerations when siting and permitting pipelines and transmission lines. Specifically these courses are the BLM's Electric Systems Short Course offered once annually at the BLM National Training Center in Phoenix, Arizona; the BLM's Pipelines Systems Course offered once annually in Durango, Colorado; and the

National Lands Training for Line Officer and Program Managers, which is jointly offered by the BLM and FS once annually in various locations.

4. Corridor Study: The BLM and the FS agree to study section 368 corridors in order to assess their overall usefulness with regard to various factors, including their effectiveness in reducing the proliferation of dispersed ROWs crossing the landscape of federal lands.

The agencies will study the section 368 corridors to assess their efficient and effective use and record practical lessons learned. The interagency workgroup will develop a corridor monitoring plan to support this study. The study is anticipated to involve an identification of the types and numbers of projects within the corridors, as well as the widths and lengths of existing ROWs within the corridors. The study would also identify where corridors are being over- or underutilized and would evaluate use of the IOPs in order to recommend potential new or modified IOPs. The study will inform the periodic review of section 368 corridors and IOPs (above at 1.b.) and be made public upon completion.

5. IM 2010-169**:** BLM agrees to delete a section, entitled "Environmental Review and Energy Corridors," from Instruction Memorandum No. 2010-169, dated July 28, 2010, upon issuance of a new BLM instruction memorandum setting forth guidance for the siting and construction of electric transmission infrastructure in section 368 corridors. BLM Instruction Memorandum No. 2010-169, dated July 28, 2010, is entitled "Implementation Guidance for the Interagency Transmission Memorandum of Understanding." The memorandum of understanding referred to was entered into by nine federal agencies in October 2009 to expedite the siting and construction of qualified electric transmission infrastructure in the United States. IM 2010-169 contains a three-paragraph section entitled "Environmental Review and Energy Corridors," which addresses section 368 corridors and directs BLM managers to tier to the environmental analysis in the FPEIS to the extent the FPEIS addresses anticipated issues and concerns associated with individual qualifying projects.

B. **Time Line for Implementation of Agreement**

The agencies agree to make every effort to meet the timelines identified below. Should the agencies be unable to meet these internal timelines for any reason, the BLM Assistant Director for Minerals and Realty Management will notify the plaintiffs and explain the circumstances causing the delay.

- Upon the Effective Date (see Section III.I) of the settlement agreement, the provisions of section II.A.2.c. shall apply.
- Upon the Effective Date of the settlement agreement, the agencies will complete a MOU within twelve months. Progress on completion of the MOU will be reported quarterly to the plaintiffs. The final MOU will be made available to the public. Upon signing the MOU, the agencies will commence a periodic review of section 368 corridors, with recommendations due twelve months thereafter.
- Upon the Effective Date of the settlement agreement, the BLM and the FS will initiate a review of current guidance. New guidance will be developed concurrently with the MOU and will be completed within twelve months. Progress on completion of guidance will be reported quarterly to the plaintiffs. New guidance will be made available to the public.
- Upon the Effective Date of the settlement agreement, the BLM and the FS will initiate a review of current training materials, instructors, and outreach efforts. Within three months the BLM and the FS will identify representatives to be invited to participate in future training. Within twelve months training courses will be revised. Progress on completion of training revisions will be reported quarterly to the plaintiffs.
- Upon the Effective Date of the settlement agreement, the agencies will initiate development of a plan to study use of the section 368 corridors. The agencies will complete the work plan within twelve months of the Effective Date of the settlement agreement. The study will be completed within twelve months of completion of the work plan. The workgroup will report progress on the study quarterly to the plaintiffs.

III. EFFECT OF SETTLEMENT

A. Subject to Defendants' compliance with the terms of Paragraphs II.A. and II.B. of this Agreement, Plaintiffs release all claims in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.).

B. Subject to the provisions of paragraph F below, upon signing the settlement agreement, plaintiffs will stipulate to the dismissal with prejudice of their amended complaint in *The Wilderness Society, et al. v. Department of the Interior, et al.*, No. 03:09-cv-03048 JW (N.D. Cal.). However, the Court shall retain jurisdiction over this action for the limited purpose of resolving settlement implementation disputes pursuant to the provisions of Paragraph F, below, until each of the following events has occurred: (1) 24 months have elapsed following execution of the MOU in accordance with Section II.A.1, above; and (2) the following undertakings have been completed: (a) new guidance has been developed in accordance with Section II.A.2, above; (b) training materials have been revised in accordance with Section II.A.3, above; (c) the Corridor Study has been completed in accordance with Section II.A.4, above; and (d) IM 2010-169 is revised in accordance with Section II.A.5, above.

C. The Federal Defendants, through the BLM and the FS, shall pay Plaintiffs the sum of $30,000.00, in full settlement and satisfaction of all of Plaintiffs' claims for attorneys' fees, costs, and other expenses in the above-captioned case. Payment shall be accomplished by electronic fund transfer. Within 5 business days of the date this Settlement Agreement is filed, Plaintiffs shall submit (if not already submitted) the account information and other information necessary for the Federal Defendants to process payment. The BLM and the FS shall undertake the procedures for processing payment within 20 days after this Settlement Agreement is filed or Plaintiffs submit the required payment information, whichever is later.

1. Release: Plaintiffs will accept the sum of $30,000.00 in full settlement and satisfaction of all of their claims for attorneys' fees, costs, and other expenses in this matter and release the Federal Defendants from any liability for attorneys' fees, costs, and other expenses incurred or claimed, or that could have been claimed, for work performed on this case, under the

Equal Access to Justice Act, 28 U.S.C. § 2412, or under any other federal or state statute or common law. Plaintiffs or their counsel shall submit confirmation of receipt of payment in the above amount to counsel for Federal Defendants, within 14 days of receipt of payment.

2. Payee: Plaintiffs represent that the proper entity to receive payment pursuant to this Settlement Agreement is Earthjustice (tax ID is 94-1730465). Payment shall be made to Earthjustice by Electronic Funds Transfer payable to:

Mechanics Bank
725 Alfred Nobel Drive
Hercules, California 94547
Bank Routing #121102036
ACCT # 040-882578

Plaintiffs and their attorneys agree that the Federal Defendants' responsibility in discharging the payment obligation provided in this Settlement Agreement consists only of making the payment to Earthjustice in the manner set forth herein.

D. Any term set forth in this Agreement (including deadlines and other terms) may be modified by written agreement of the Parties.

E. Except as expressly provided in this Agreement, neither of the Parties waives or relinquishes any legal rights, claims, or defenses it may have.

F. In the event of a disagreement among the Parties concerning the performance of any aspect of this Agreement, the dissatisfied party shall provide the other party with written notice of the dispute and a request for negotiations. The Parties shall meet and confer in order to attempt to resolve the dispute within 30 days of the date of the written notice, or such time thereafter as is mutually agreed. If the Parties are unable to resolve the dispute within 90 days after such meeting, then any Party may apply to the Court for resolution. In resolving such dispute, the Court's review shall be limited to determining: (1) whether the Federal Defendants have reasonably complied with the performance deadlines set forth in Section II.B; (2) whether the MOU required by Section II.A.1 contains the terms required by this Agreement; (3) whether the guidance issued in accordance with Section II.A.2 contains the terms required by this Agreement; (4) whether the training developed by the agencies addresses the issues identified in

Section II.A.3; (5) whether the study prepared by the agencies contains the terms set forth in Section II.A.4; and (6) whether IM 2010-169 has been revised in accordance with Section II.A.5. The Parties agree that any challenge to a final decision concerning amendments or revisions to land use plans, as well as to final decisions concerning revisions, deletions, or additions to Section 368 corridors, must take the form of a new civil action under the judicial review procedures of the Administrative Procedure Act, 5 U.S.C. §§ 701–706. The parties will not seek the remedy of contempt for any alleged violation of the settlement agreement.

G. Any notices required or provided for under this Agreement shall be in writing, shall be effective upon receipt, and shall be sent to the following:

For Plaintiffs:

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<u>For Defendants</u>:

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H. Upon written notice to the other party, either party may designate a successor contact person for any matter relating to this Agreement.

I. The undersigned representatives of each party certify that they are fully authorized by the parties they represent to bind the respective Parties to the terms of this Agreement. This Agreement shall become effective upon signature on behalf of all of the Parties set forth below and upon the Court's entry of an order of dismissal in accordance with Section III.B above (the "Effective Date"). This Agreement may be executed in any number of counterpart originals, each of which shall be deemed to constitute an original agreement, and all of which shall constitute one agreement. The execution of one counterpart by any party shall have the same force and effect as if that party has signed all other counterparts.

ON BEHALF OF ALL PLAINTIFFS

DATED: July 3, 2012

/s/James S. Angell

JAMES S. ANGELL
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Counsel for Plaintiffs, The Wilderness Society, Bark; Center for Biological Diversity; Defenders of Wildlife; Great Old Broads for Wilderness; Klamath-Siskiyou Wildlands Center; National Parks Conservation Association; National Trust for Historic Preservation; Natural Resources Defense Council; Oregon Natural Desert Association; Sierra Club; Southern Utah Wilderness Alliance; Western Resource Advocates; Western Watersheds Project; County of San Miguel, CO

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FOR THE FEDERAL DEFENDANTS:

IGNACIA S. MORENO
Assistant Attorney General

DATED: July 3, 2012

/s/ David B. Glazer

DAVID B. GLAZER
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United States Department of Justice
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ATTORNEY ATTESTATION OF CONCURRENCE

I hereby attest that I have obtained concurrence in this filing and for affixing the signature of Plaintiffs' counsel, indicated by a "conformed" signature ("/s/"), to this e-filed document, in accordance with General Order 45.X.

Dated: July 3, 2012

/s/*David B. Glazer*
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Attachment 2

Exhibit A
To
Settlement Agreement,
The Wilderness Society et al. v. United States Department of the Interior et al.,
3:09-cv-03048 JW (N.D. Ca.)

Per Section II.A.1. of the above-captioned Settlement Agreement, “corridors identified by plaintiffs as having specific environmental issues” are listed below, along with plaintiffs’ concerns over affected resources as identified by plaintiffs in the above-captioned lawsuit. Corridor numbers in boldface correspond to those set forth in Appendix A of the Programmatic Environmental Impact Statement, *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386, November 2008) and in the Records of Decision issued by the Bureau of Land Management and U.S. Forest Service in January 2009.

WASHINGTON
102-105: numerous “suitable” segments under Wild & Scenic Rivers Act, borders designated Wilderness, Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves, crosses Pacific Crest Trail, tracks America’s Byway within 1 mile, National Register of Historic Places property.
244-245: conflicts with Northwest Forest Plan, critical habitat, tracks America’s Byway.

OREGON
7-24: 3 citizen-proposed wilderness areas, sage-grouse habitat, pygmy rabbit habitat, Steens Mountain Cooperative Management Area, and proposed Sheldon Mountain National Wildlife Refuge.
230-248: critical habitat, National Register of Historic Places property, Pacific Crest Trail, Clackamas Wild & Scenic River and other “eligible” segments under Wild & Scenic Rivers Act, conflicts with Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves.
24-228 (also in Idaho): sage-grouse habitat, National Register of Historic Places property.
4-247 – not close enough to QRA, old-growth forests, critical habitat, late-successional reserves, riparian reserves.

IDAHO
24-228 (also in Oregon): sage-grouse habitat, pygmy rabbit habitat.
229-254 (also in Montana - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act.

WYOMING
Any in core areas are prohibited for transmission use by BLM guidance.
78-255: sage-grouse core area and habitat.
79-216: sage-grouse core area and habitat, National Register of Historic Places properties, National Historic Trail.
121-221: sage-grouse core area and habitat, National Historic Trail, BLM special management area.

MONTANA
229-254 (also in Idaho - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, "suitable" segment under Wild & Scenic Rivers Act, Continental Divide Trail, USFS Inventoried Roadless Area.

CALIFORNIA
18-23: Areas of Critical Environmental Concern, Inventoried Roadless Areas, BLM Wilderness Study Areas, CA Boxer Wilderness, CA-proposed Wilderness, NV-proposed Wilderness, sage-grouse habitat, redundant to 18-224.
23-106: National Conservation Area, Area of Critical Environmental Concern.
23-25: critical habitat, National Conservation Area, Area of Critical Environmental Concern.
264-265: critical habitat, National Conservation Area, citizen-proposed Wilderness, USFS Inventoried Roadless Area.
107-268: National Forest, citizen-proposed Wilderness.
101-263: critical habitat; WSR; CA-proposed Wilderness, citizen-proposed Wilderness, USFS Inventoried Roadless Area.

NEVADA
17-35: access to coal plant, impacts to sage-grouse habitat.
16-24: Wilderness, National Conservation Area, National Historic Place, BLM Wilderness Study Area (in Oregon).
16-104: BLM Wilderness Area.
44-110: sage-grouse habitat.
110-233: sage-grouse habitat.
110-114: sage-grouse habitat, undisturbed, USFS Inventoried Roadless Area.
223-224: Areas of Critical Environmental Concern, Desert National Wildlife Refuge.
39-113, 39-231: Pahranagat National Wildlife Refuge, Rainbow Gardens ACEC, near proposed Gold Butte National Conservation Area, Black Mountain tortoise habitat.

UTAH
110-114: much undisturbed, National Historic Place, BLM Wilderness Study Area, UT-proposed Wilderness.
66-259: access to coal plant, impacts to USFS Inventoried Roadless Area.
66-212: access to coal plant, impacts to National Historic Places, America's Byways, Old Spanish Trail, BLM Wilderness Study Area, UT-proposed Wilderness, critical habitat, adjacent to Arches National Park.
116-206: undisturbed, monument, Old Spanish Trail, UT-proposed Wilderness, near USFS Inventoried Roadless Area.
68-116, Grand Staircase National Monument, Paria River.
126-258: access to coal plant.

COLORADO
130-274 and 130-274(E): access coal, directly or indirectly impacts Gunnison sage-grouse conservation areas, occupied Gunnison sage-grouse habitat, CO-proposed Wilderness, USFS IRA.
87-277: coal, Wilderness, sage-grouse habitat; National Historic Places.
144-275: coal, wilderness, National Historic Places.

ARIZONA
68-116: access to coal, impacts to Grand Staircase-Escalante National Monument, Wild & Scenic Rivers, scenic byway.
62-211: access to coal, impacts to citizen-proposed and designated Wilderness, National Historic Place, Wild & Scenic Rivers, Mexican spotted owl critical habitat.
47-231: desert tortoise and bonytail critical habitat, Area of Critical Environmental Concern, Lake Mead National Recreation Area.
41-47: impacts to Black Mountain population for desert tortoise.
41-46: impacts to Black Mountain population for desert tortoises.
46-270: Wild & Scenic river, Southwestern willow flycatcher critical habitat.
46-269: proposed and designated Wilderness areas, Wild and Scenic Rivers, Three Rivers Area of Critical Environmental Concern.

NEW MEXICO
81-272: Sevilleta National Wildlife Refuge, National Conservation Areas.

Attachment 3

Table 2-1
Areas with Known Sensitive Resources Eliminated from REDA Consideration

Areas with Known Sensitive Resources	Source
BLM Areas of Critical Environmental Concerns	BLM 2011
BLM Backcountry Byways	BLM 2011
BLM Designated Wilderness and Wilderness Study Areas	BLM 2011
BLM lands with wilderness characteristics managed to protect those characteristics	BLM 2011
BLM lands with wilderness characteristics not managed to protect those characteristics	BLM 2011
BLM Visual Resource Management Classes I, II, and III	BLM 2011
BLM Special Recreation Management Areas	BLM 2011
BLM ROW exclusion or avoidance areas	BLM 2011
BLM Herd Management Areas	BLM 2011
Gila River Terraces ACEC	BLM 2011
Cultural sites well documented by the BLM, including House Rock Valley, Poston Butte, Petrified Forest Expansion Area, Gila River Terraces , and Clanton Hills	BLM 2011
Designated BLM utility corridors	BLM 2011
National Monuments	BLM 2011
National Conservation Areas	BLM 2011
Wild and Scenic Rivers (either eligible for or suitable for inclusion in the National Wild and Scenic Rivers System or rivers included in the National Wild and Scenic Rivers System)	BLM 2011
National Park System units, including Petrified Forest National Park Expansion Area	BLM 2011, SWReGAP 2011
National Park System National Historic Trails (0.25-mile buffer each side)	BLM 2011
Tribal lands	BLM 2011
Military lands	BLM 2011
State parks	Arizona State Parks 2010
State wildlife areas	BLM 2011
USFWS lands	BLM 2011
The Nature Conservancy conservation easements, Audubon Society land, and private conservation easements	SWReGAP 2011
US Forest Service Designated Wilderness	Forest Service 2010a
US Forest Service Established Research Natural Areas	Forest Service 2010b
US Forest Service Inventoried Roadless Areas	Forest Service 2010c
US Forest Service Heber Wild Horse and Burro Area	Forest Service undated
US Forest Service Special Interest Management Areas	Forest Service 2010b

Table 2-1
Areas with Known Sensitive Resources Eliminated from REDA Consideration

Areas with Known Sensitive Resources	Source
Incorporated cities (except when BLM land is included within the boundaries of an incorporated city)	ALRIS 2011
AGFD Areas of Conservation Potential, Tiers 4, 5, and 6	AGFD 2011
AGFD important big game habitat, including bighorn sheep, black bear, elk, javelina, mountain lion, mule deer, turkey, and white-tailed deer.[1]	AGFD 1988
Special status species, including threatened, endangered, and BLM sensitive species locations	AGFD 2010, BLM 2011
AGFD wildlife corridors	AGFD undated
USFWS critical habitat for threatened and endangered species	USFWS 2010
BLM sensitive species habitat	BLM 2011
Sonoran desert tortoise (*Gopherus agassizii*) Sonoran population habitat categories I, II, and III	BLM 2011
Desert tortoise conservation areas from the Solar PEIS	BLM and DOE 2012b
National Wetland Inventory wetlands	NWI 2010
Water bodies (lakes, rivers, and dry lakes)	BLM 2011
Federal Emergency Management Agency 100-year floodplains	FEMA 2010
Areas of high potential for known mineral deposits, metallic mineral districts, and Holbrook Basin potash potential	AZGS 2008, Arizona Bureau of Geology and Mineral Technology 1983, Arizona Bureau of Mines 1993
Sensitive fossil resources	BLM 2011
Severe soils: Clay Springs (runoff medium to rapid and erosion hazard moderate to severe) and Rositas (wind erosion severe if natural surface and cover disturbed)	BLM 2011, Description of Soil Series 2010
Greater than 5 percent slopes (or greater than 15 percent slopes for areas with wind potential)	USGS 2010, BLM 2011
REDAs less than 8 acres unless contiguous with larger REDAs	BLM 2011

[1]Bighorn sheep high density, medium, low, and sparse; black bear, high, medium, and low; elk summer high, medium, and low plus winter very high, high, medium, and low; javelina high and medium; mountain lion high; mule deer summer Kaibab high and medium, high plus winter Kaibab high and medium, high and medium; turkey summer high and medium plus winter high, medium, and low; white-tailed deer high and medium. Arizona Game and Fish Department describes wildlife density as number of animals per square mile.

Appendices A & B

Appendix A: Effects of Transmission Development on Desert Wildlife Species

Impacts of linear developments such as roads, pipelines, and transmission lines on wildlife include habitat loss and modification, edge effects on core areas, population subdivision/isolation, disturbance, direct mortality, and increased human access (Andrews 1990). In arid environments, life and the resources that sustain it can be sporadic and unpredictable, and this makes development impacts and the recovery process highly variable and site-specific.

The most noticeable impact of transmission development on wildlife is direct habitat loss and modification to build roads, staging areas, structure pads, substations, etc. Each mile of transmission line that is built in the desert southwest compacts an estimated 99-159 acres of soil.[1] In many cases, ROW vegetation is maintained at an earlier successional state by cutting, mowing, or spraying and never allowed to return to pre-development conditions. When recovery is allowed, time required to attain previous conditions is dependent on the type and severity of disturbance; areas where fires or vegetation removal have occurred with no soil removal and little compaction typically recover most quickly, followed by transmission ROWs, roads, then pipelines, which can take one to several centuries due to the degree of soil disturbance involved. An analysis of 47 studies estimated time to reestablish native plant communities after disturbance in the Sonoran and Mojave deserts.[2] Based on this analysis, the average time estimated to recover perennial plant cover was 76 years, but recovering pre-disturbance species composition was estimated to take 215 years on average. Other studies have directly tied regeneration time to degree of soil compaction, which inhibits seedling emergence, root growth, and nutrient uptake. Fundamentally, restoration of impacted sites through active intervention is impractical at this time, as the low-cost method (restoring Sonoran desert vegetation from seed) has only a 10% success rate, while effective restoration methods (using container plants) are prohibitively expensive at $177,210 to $284,610 per mile of line.[3] Given this, in many cases avoidance and minimization of key habitats is the best strategy for wildlife conservation.

Other impacts on wildlife from transmission development, although more difficult to quantify, are of equal or greater importance for wildlife species, and these impacts vary substantially between species. Several species are listed on the following chart. The fringe-toed lizards have clearly defined, essential habitats (dune habitats, vernal pools) that are typically avoided during siting; direct impacts to these species are unlikely, but the integrity of their fragile habitats must be maintained during and after development. Other species, like the desert tortoise and the spade-foot toad, are poor dispersers that hibernate for much of the year and rely on access to seasonal resources such as annual plant blooms and vernal pools; their seasonal use areas and access to resources must be maintained, even though their activities are invisible to us for most of the year. A third group of species, represented by golden eagle, great egret, and Sonoran pronghorn, range widely to access needed resources but have inherent conflicts with development that must be reconciled. Golden eagles are perching hunters, but the perches provided by some transmission structures cause direct eagle mortality while putting vulnerable prey species like desert tortoise at risk. Great egrets are vulnerable to fatal collisions with poorly-sited power lines that intersect flyways between breeding and foraging areas. Pronghorn are not directly threatened by power lines, but their predator avoidance behavior makes disturbance and fragmentation impacts from transmission development potentially problematic.

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[1] Brum, G.D., R.S. Boyd, and S.M. Carter. 1983. Recovery rates and rehabilitation of powerline corridors. Pp. 303-14 in Environmental Effects of Off-Road Vehicles: Impacts and Management in Arid Regions ed by R. H. Webb and H.G. Wilshire. Springer-Verlag: New York.

[2] Abella, Scott R., "Disturbance and plant succession in the Mojave and Sonoran Deserts of the American Southwest" (2010). Faculty Publications (SEPA). Paper 357. http://digitalcommons.library.unlv.edu/sea_fac_articles/357

[3] Bean, T.M., S.E. Smith, and M.M. Karpiscak. 2004. Arizona's hot desert; the advantage of container stock. Native Plants Journal 5:173-180.

Species Group	Construction-Related Habitat Disturbance	Surface Occupancy/ Operations and Maintenance	Linear Habitat Loss or Modification Within ROW	Road Effects	Visual Disturbance	Fencing/Barriers	Transmission Structures and Conductors
Fringe-Toed Lizards (Mojave, Yuman)	Dune obligate species; avoid dunes and preserve sand transport.	Vehicle use damages dune habitat, OHV hearing damage potential.	Avoid dune habitats, avoid disrupting sand transport	Site roads to avoid dunes and preserve sand transport	None noted.	No issues with typical fencing.	None noted.
Plains Spade-foot Toad	Avoid disturbance of burrows and disruption of vernal pool habitat.	OHV noise can cause early emergence (mistaken for rainfall), OHV mortality potential.	Sensitive to herbicides and pesticides--avoid application in habitat.	Unable to cross major roads, vehicle mortality possible on minor roads at night.	None noted.	No issues with typical fencing.	None noted.
Mojave & Sonoran Desert Tortoise	Both subspecies are vulnerable to fragmentation effects from roads, ROWs, and associated transmission development; define important habitat and avoid.	OHVs decreases density of herbaceous forage by a factor of three, spread invasive weeds, increase fire frequency, compact soil, and limit habitat use. Limit use.	Sonoran prefers rocky uplands, ridgeline transmission potentially high impact; Mojave more affected by lowland development.	Avoid road exclusion fencing that prevents needed movement as well as vehicle mortality; use strict speed limits to prevent collisions	None noted.	Stranded livestock fencing typically used for livstock does not block movement, but other fence types can.	Predation risk increases near structures due to raptor and corvid perching and ROW use.
Golden Eagle	Avoid disturbance of important nest, roosting, and foraging areas	Avoid disturbance of important nest, roosting, and foraging areas	Habitat modification within ROWs and perch availability attract eagles for hunting and nesting. Limit activity through perch management.	Use of roadside areas for hunting and scavenging frequently results in vehicle mortality.	Avoid visual disturbance near nesting areas.	Fatal eagle collisions with fences are not a major source of documented mortality.	Eagle attraction to structures is a high electrocution risk and increases predation pressure on tortoise and other species--prevent perching.
Great Egret	Avoid siting near permanent and seasonal water features heavily used by waterbirds, avoid breeding season disturbance of these areas.	Ongoing O&M typically avoids overlap with waterbird foraging and nesting habitat; few conflicts.	ROW placement should avoid overlap with waterbird foraging and nesting habitat to minimize conflicts.	Road mortality possible, particularly when roads are sited near or between foraging and nesting habitats. Avoid these configurations.	None noted.	Fatal waterbird collisions with fences do occur, but are not a major contributor to documented mortality.	Avoid siting between use areas to prevent transmission line collisions mortality.
Sonoran Pronghorn Antelope	This extremely visual, mobile, and skittish grazer depends on awareness and speed for survival, strongly avoiding areas with heavy development. No development in areas important for water and forage availability, avoid blocking migration corridors.	Sensitive to noise and visual disturbance, small disturbances can result in large-scale movements; avoid key areas during fall breeding and spring fawning .	Prong horn exhibit some degree of habituation to transmission structures if there is little or no associated human disturbance.	Pronghorn avoid heavily used roads. Avoid road construction in areas pronghorn need to move to access forage, water, and migration routes	Sensitive to visual disturbance from tall structures.	Improperly designed livestock fencing (mesh fencing or stranded fencing with low wires) can ensnare pronghorn or block movement.	Predation risk for fawns increases near structures due to raptor and corvid perching and ROW use.

Appendix B: Mapping Discussion and Results

A preliminary GIS overlay analysis was conducted by the ASWG to determine risk of potential wildlife impacts from transmission lines in three corridors in southwestern Arizona. Potential wildlife impacts were assessed by overlaying species ranges, critical habitat and migration corridors with the possible transmission routes.

Species were selected by members of the Arizona Solar Working Group and Arizona Game and Fish Department to reflect conservation priorities in the region. Some species, such as Sonoran Desert Tortoise, were chosen for their regional importance as a key species and an indicator of high-quality, connected Sonoran Desert habitat. Others, such as the Mojave Fringe-Toed lizard, were chosen because of their reliance on specific, limited types of habitat where disturbance could be very damaging for species viability. We chose several big game species important to the state that are vulnerable to the effects of habitat fragmentation, such as Desert bighorn sheep, American pronghorn, and mule deer. We also examined two bat species, California leaf-nosed bat and Lesser long-nosed bat, as the impacts of transmission lines on bat species are relatively unknown and these species of conservation need may be vulnerable to direct or indirect impacts. Finally, we examined both the designated critical habitat and modeled suitability range for a suite of Arizona's threatened and endangered species, from Sprague's pipit to a number of fish species.

Maps of a few representative species distributions are shown below, and this section concludes with a table showing the overlap, by acres, of each of the modeled suitability habitats with the various corridor alternatives studied.

Wildlife and migration/connectivity GIS data was provided by Arizona Game and Fish Department. Critical habitat data was provided the US Fish and Wildlife Service. Each of these datasets provides a different lens on potential wildlife impacts and comes with its own benefits and drawbacks.

- **Critical Habitat:** Critical habitat is legally designated and "contains features essential for the conservation of a threatened or endangered species and that may require special management and protection."[4] While critical habitat may include recovery or experimental areas, it is not generally intended to encompass the full range of the habitat for that species, and therefore there may be other places on the landscape where those species are at substantial risk, in addition to within their critical habitats.

- **Species Distributions:** AZGFD's species distribution models, on the other hand, likely over-predict occupied and at-risk habitat and are therefore more conservative tools to estimate wildlife impact risk. These models were built for most Species of Greatest Conservation Need in fulfillment of Element 1 of the State's Wildlife Action Plan, and were built using SWReGAP Land Cover as a base layer. The layers represent *predicted* range for the species, based on factors such as land cover, elevation, soil type, etc. A species may or may not be present at any given point within its predicted distribution, but it is more likely to be found within the distribution than outside of it.

- **Wildlife Corridors and Connectivity:** AZGFD has also worked closely with other agencies, stakeholders, counties, and scientists at Northern Arizona University and elsewhere to develop an ongoing modeling process for important wildlife linkages throughout the state. These linkages are

[4] USFWS (2009). Critical Habitat—What is It? Fact Sheet available at https://www.fws.gov/midwest/Endangered/saving/CriticalHabitatFactSheet.html [Accessed 4/24/2014].

designed to connect large intact (unfragmented) blocks of movement habitat important for multiple wildlife species of state concern, and represent the best routes through appropriate habitat for a wide variety of species. Maintaining the integrity of the wildlife movement areas and intact habitat blocks, as well as the linkages that connect them, is essential to maintaining the viability of Arizona's unique wildlife populations in the face of pressures from development, fragmentation, climate change, drought, and other concerns. AZGFD and its partners initially developed preliminary models of potential habitat blocks and linkages throughout the state in 2006-2007, and then over time have prioritized the development of detailed models in various places. All the models are shown in Figure 3 below, and all linkages and large intact blocks should be protected from fragmentation through the use of the mitigation hierarchy and in consultation with the Arizona Game and Fish Department.

Where additional management tools and species-specific information, such as AZ BLM's habitat management units for Sonoran Desert Tortoise or AZGFD's Heritage Data Management System exist, BLM should incorporate those datasets into its analysis of species impacts and use them to inform its use of the mitigation hierarchy in avoiding, minimizing, and where appropriate offsetting wildlife impacts.

Overall we recommend the BLM and USFS consult with the USFWS and AZGFD to interpret the best available information from BLM, AZFGD, and USGS models, which should inform screening potential WWEC for conflicts with important low density, habitat connectivity and dispersal habitats for special status species. If WWEC conflict with the habitat screens, the BLM and USFS should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict.

Transmission corridor centerline information for the I-10 and I-8 routes was provided by the BLM via the WWEC PEIS website and subsequently processed by buffering the transmission centerlines by one mile on either side, creating a two-mile wide corridor—substantially wider than the 3,500-ft default width of the majority of the WWECs. We chose to buffer the corridors in order to account for the fact that transmission corridors can have a variety of impacts upon species, depending on the species and mode or vector of impact. Many species of concern are impacted most heavily by direct disturbance and fragmentation resulting from the construction and presence of the line and its associated infrastructure, and we would need only a narrow buffer radius to identify these species. Other species experience transmission lines as movement barriers at the landscape scale, and it would be appropriate to look several miles out to identify any populations of these species and their potential migratory corridors. On the far end, some species are impacted by increased predation from raptors and corvids taking advantage of perching and nesting opportunities provided by the wires and towers. Several studies have identified predation impacts by ravens extending as far as 4.3 miles in either direction from a transmission line in some landscapes.[5]

In choosing a one-mile buffer, ASWG is seeking to strike a middle ground accounting for these types of impacts and past precedent in corridor planning and analysis. Using a 4+ mile buffer could result in over-prediction of impacted species and lead to an artificially long list of species to review for further study, given that only some species are at risk from raptor or corvid predation (in the case of those species, such as sage grouse and desert tortoise, however, it would be appropriate to consider potential

[5] Boarman, W., B. Heinrich. 1999. Corvus corax: Common Raven. The Birds of North America, 476: 1-32; Leu, M., Hanser, S.E., and Knick, S.T., 2008, The human footprint in the west-A large scale analysis of anthropogenic impacts: Ecological Applications, v. 18, p. 1119-1139.

siting impacts as far as 4 miles from the corridor). We also base this recommendation on choices made in a number of recent studies and models:

- The Eastern Interconnection States' Planning Council (EISPC) Energy Zones (EZ) Map viewer allows for a choice of a 1- or 2-mile buffer (for a corridor diameter of 2 or 4 miles) when running "imperiled species" and "habitat" analysis tools.

- The California Energy Commission utilized a 0.5-mile buffer to measure critical habitat near proposed line corridors in its model supporting recommendations for the report Planning Alternative Corridors for Transmission.[6] We feel this buffer width is too small to capture the full range of species potentially impacted by a line, but may be useful for analyzing impacts to species affected most directly by construction and habitat fragmentation from the line itself.

- The Electric Power Research Institute developed a model for creating and screening "macro-corridors" which may "have a width of as much as a mile or greater for segments that have substantial length through areas of high suitability, while still allowing enough width in the low suitability areas for the right-of-way requirements of the project."[7]

By contrast, the Bureau of Land Management used a 4-mile buffer on either side of proposed subroutes for the SunZia project to define a study corridor for the identification of potentially occurring species (SunZia DEIS 3.6.12). We feel that this broad corridor, while useful for conservatively capturing the full range of possible species affected, is wider than necessary for the task of identifying species at potential risk from corridor placement and informing further, more detailed studies. In order to test whether a broader buffer would be useful, ASWG buffered the federal WWEC corridors to 1- and 2-mile radius and examined overlap with AZGFD predicted habitats for 13 initial species. No species had overlap with the 2-mile buffer that did not also have overlap with the 1-mile buffer, indicating that a 1-mile buffer should be sufficient to capture an appropriate representation of potentially impacted species.

Due to the origin of the centerline data for these routes, which did not contain alignment information on private land, our analysis was also only conducted on public land.

Transmission corridor information for the I-11 route was suggested to be evaluated in parallel or as a part of the currently ongoing I-11 studies by Arizona and Nevada DOTs; as such, it does include information about route alignment on private land. However, it also includes numerous alignment options - which are displayed and discussed below as numbered segments.

[6] Deming, Mary Beard. 2009. Planning Alternative Corridors for Transmission. California Energy Commission. PIER-Energy-Related Environmental Research Program. CEC-5002009-079.

[7] EPRI-GTC Overhead Electric Transmission Line Siting Methodology. EPRI, Palo Alto, CA, and Georgia Transmission Corporation, Tucker, GA: 2006. 1013080.

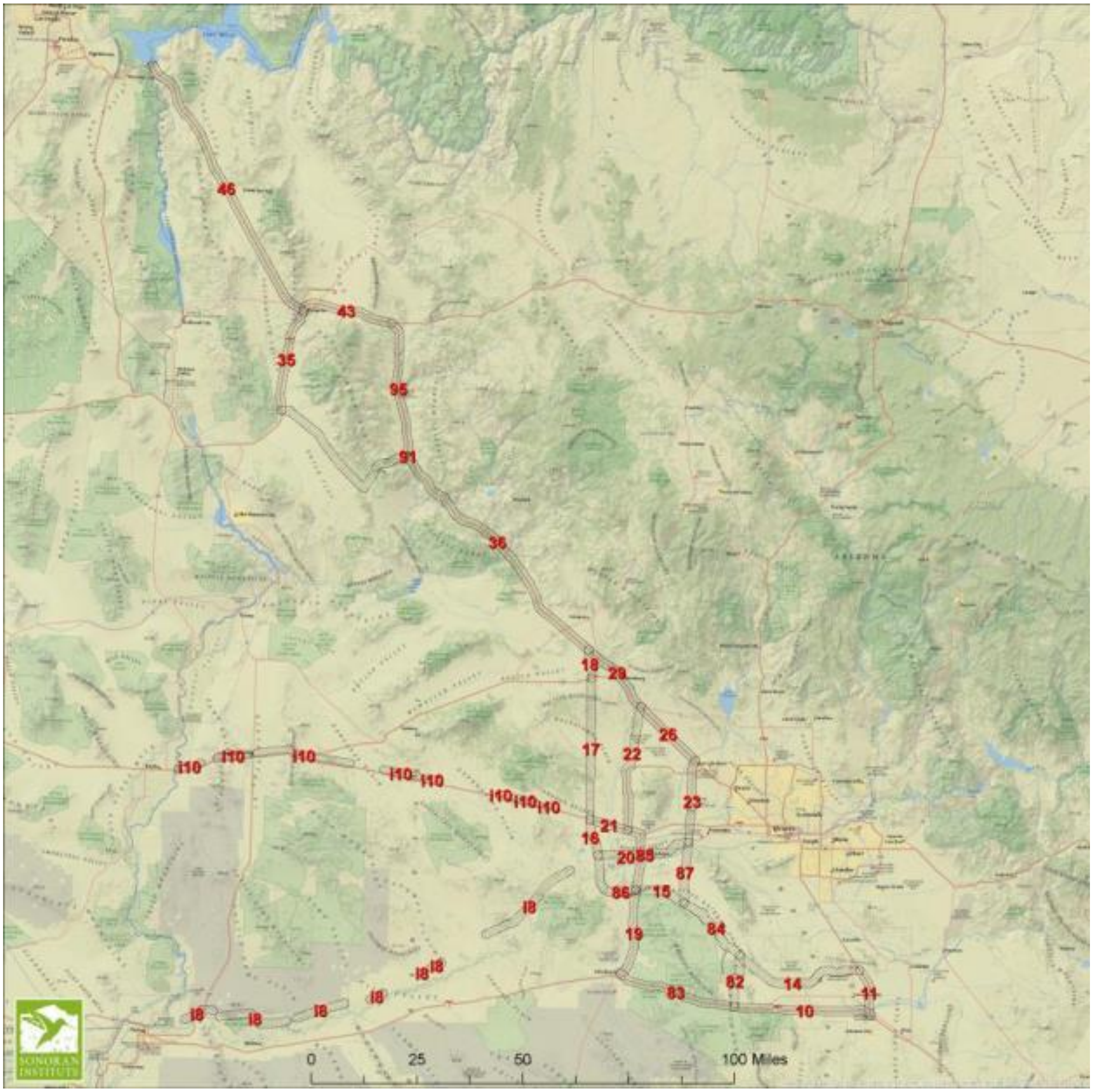

Figure 1: Corridor Locations.

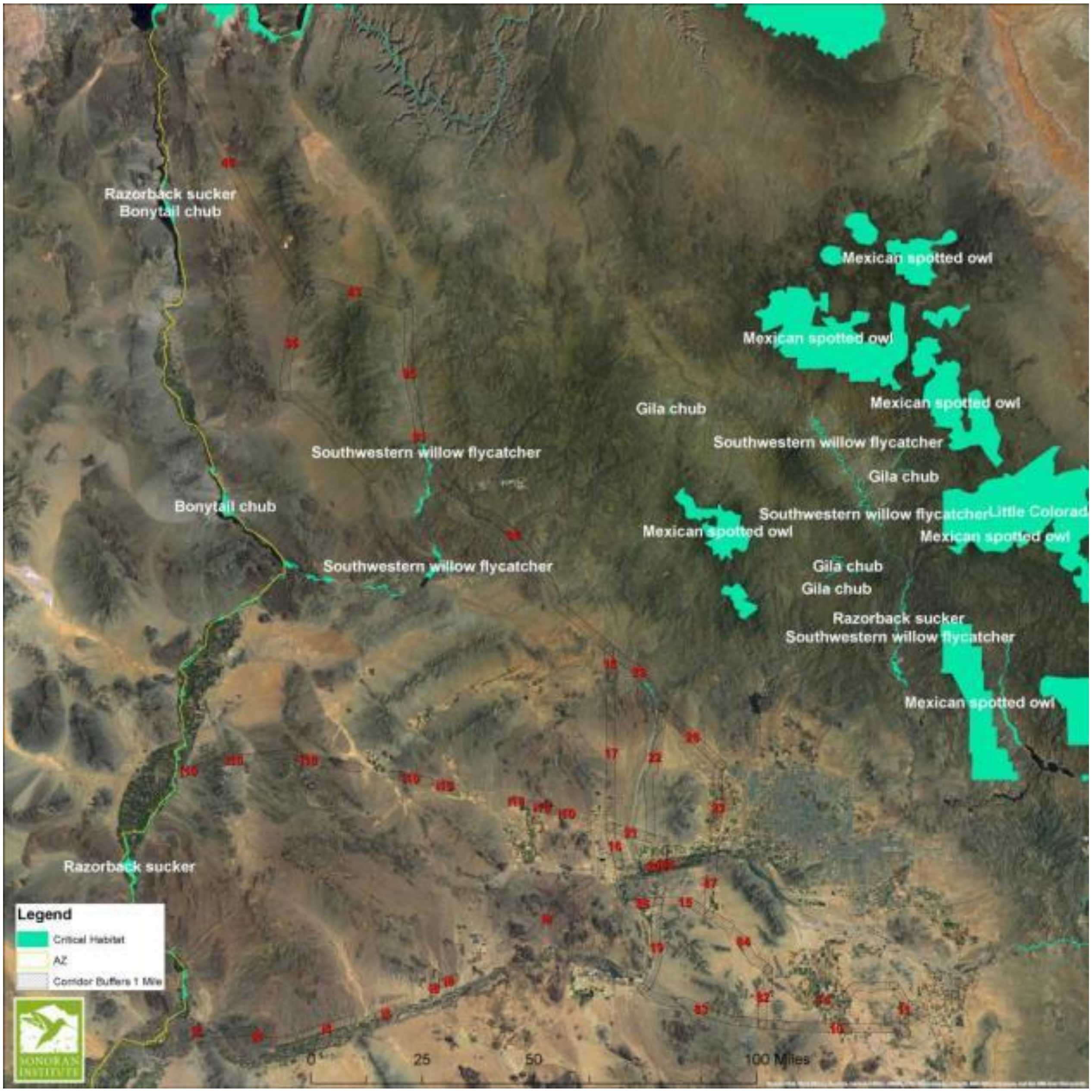

Figure 2: Designated Critical Habitat.

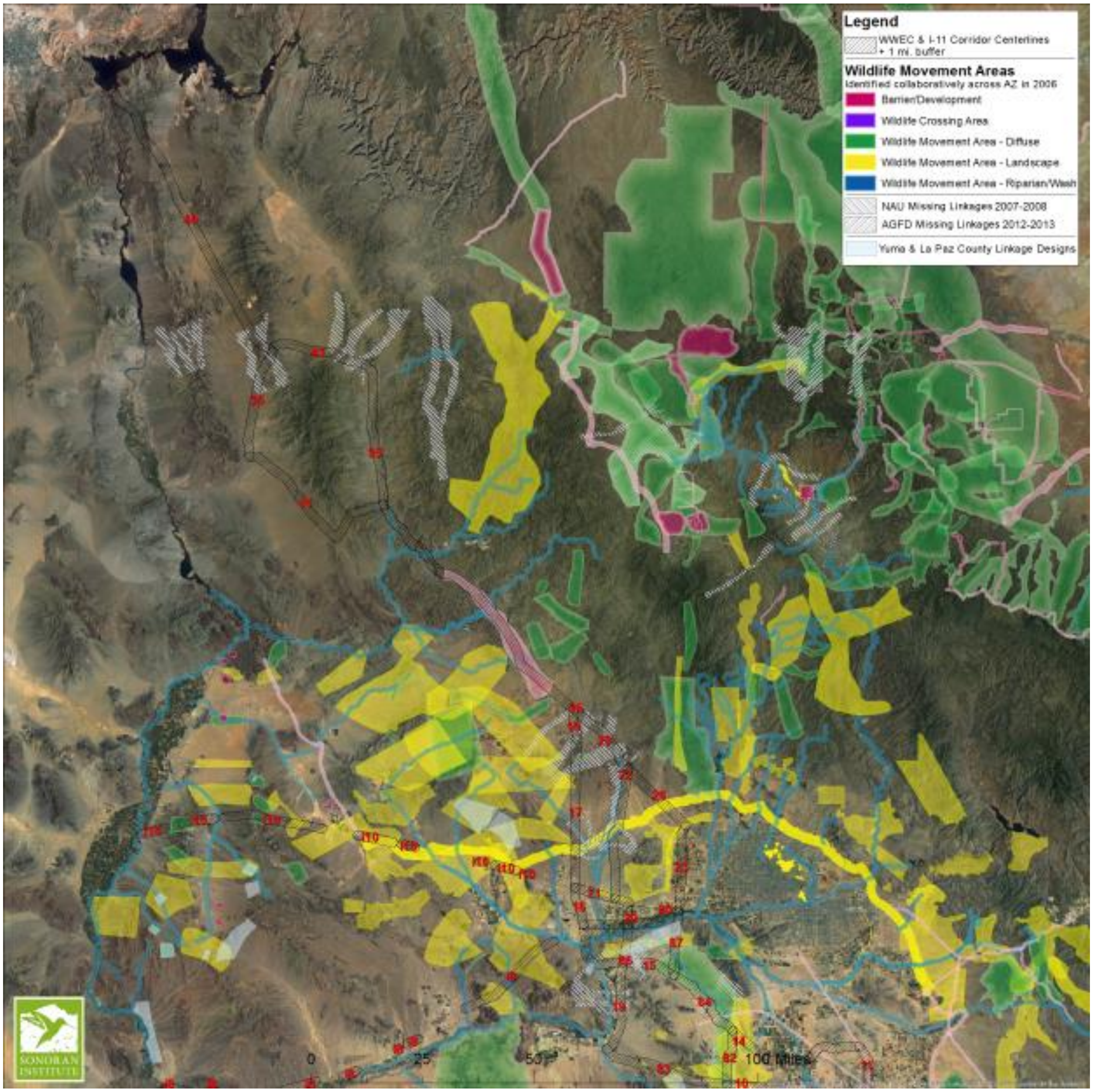

Figure 3: Wildlife Linkage Corridors, including preliminary statewide wildlife movement areas (colored blocks, identified via a collaborative process in 2006); "missing linkages" designed by Northern Arizona University in priority areas in 2007-2008 and by AZGFD in 2012-2013; and Yuma and La Paz County detailed linkage designs developed by local stakeholders. Wildlife movement areas, dispersal areas, and linkages are all essential for maintaining connectivity across the landscape.

Species Range

Species ranges, as determined by AZGFD habitat modeling described above, were compared; the transmission corridors and acreage of overlap was used as an indication of potential impact for the species. See the table below with each species and the number of acres that would potentially be impacted by build-out of each transmission line or segment.

Acreage of potential impact is not the only metric to consider when evaluating the possible impacts of transmission lines. Transmission lines represent a greater threat to some species than others, and those threats come from a variety of sources unique to the species and habitat. Also, some species have much smaller ranges than others, so an acre of impacted habitat for a species with limited distribution may represent a greater threat to their overall population than 100 acres of a wide-ranging species. However, we feel that these overlays provide useful direction when evaluating potential transmission corridors; and they quickly flag species and geographies that will require further analysis in the permitting process.

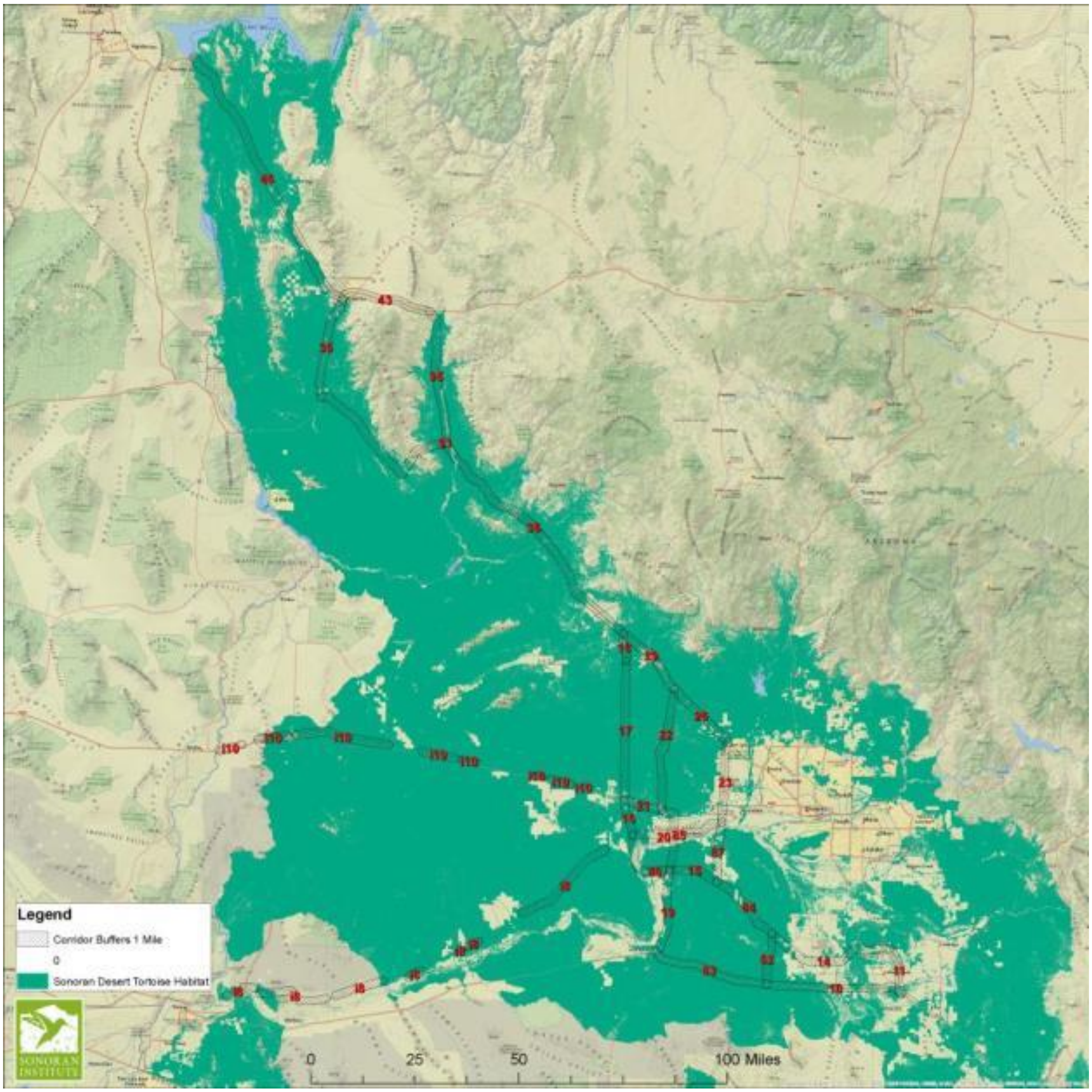

Figure 4: The Sonoran Desert Tortoise has extensive habitat overlap with all proposed transmission lines. On public lands, follow AZ BLM procedures outlined in IMAZ-2012-031, "Desert Tortoise Mitigation Policy" (2012), and the Desert tortoise rangewide plan.

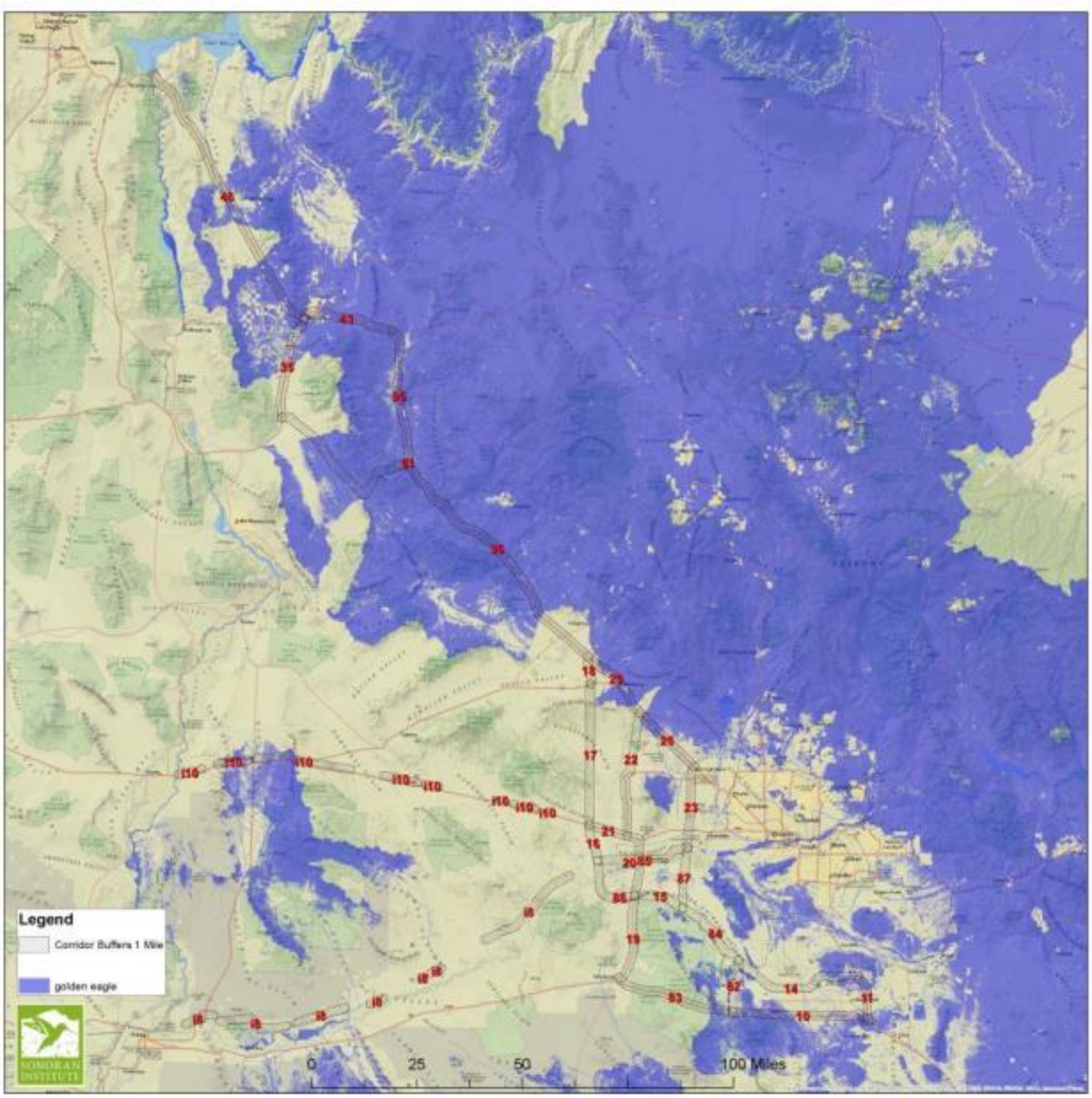

Figure 5: Golden eagles are likely to be impacted by impacts to nesting, roosting and foraging areas, rather than increased predation.

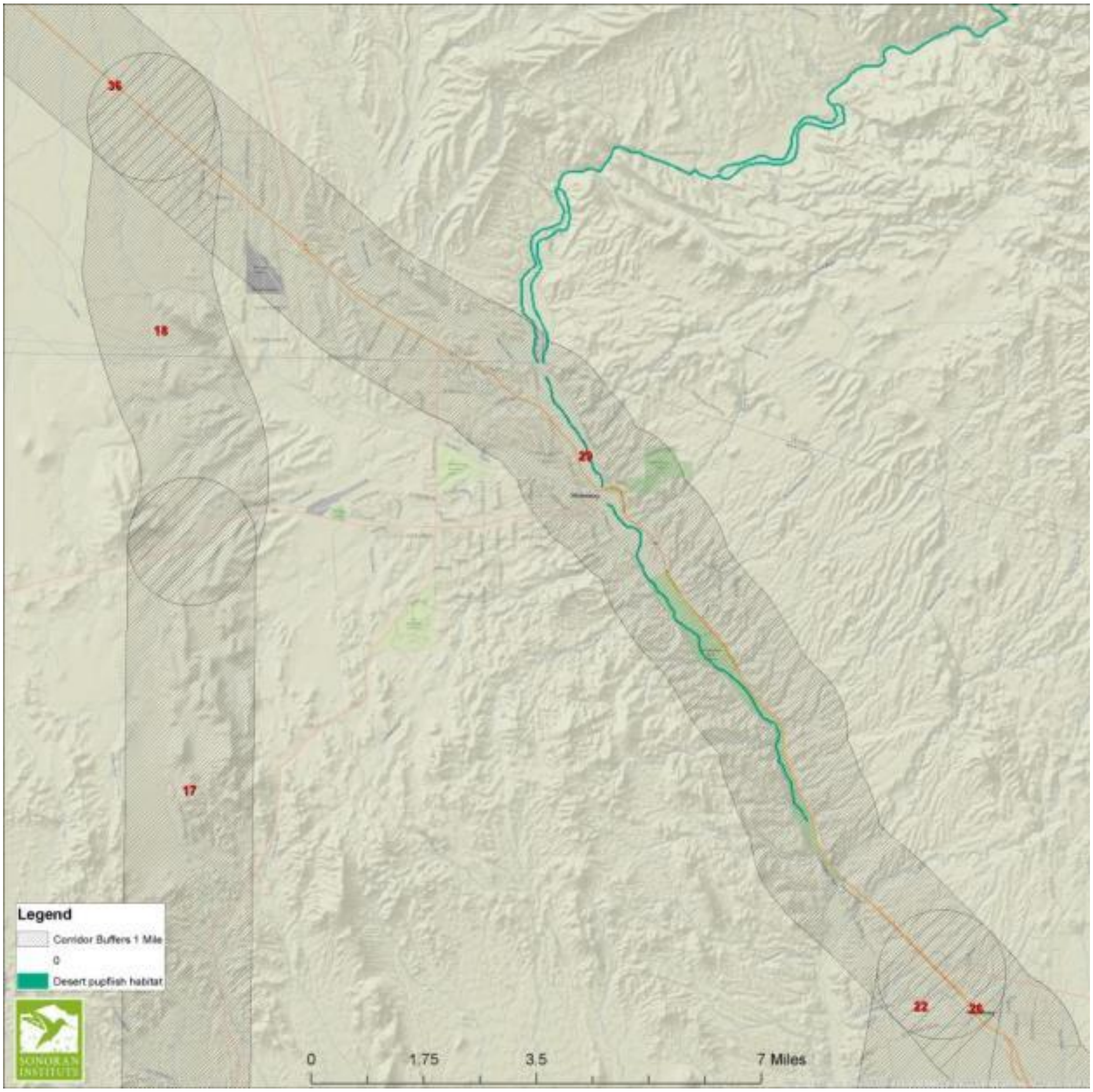

Figure 6: As an aquatic species, Desert pupfish have minimal acreage overlap with proposed transmission corridors; however, given their limited range any overlap at all is important to consider.

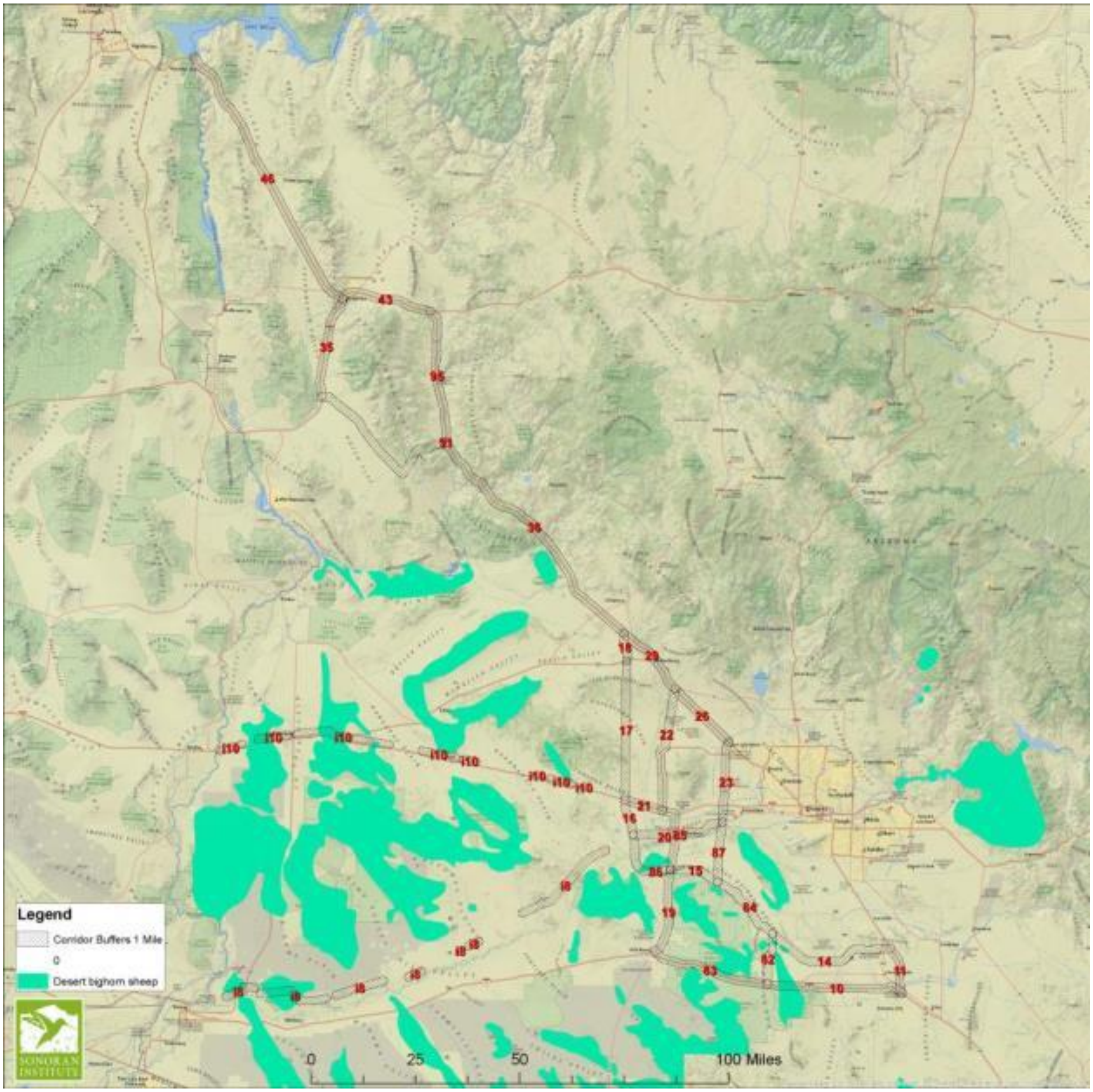

Figure 7: Desert bighorn sheep could be impacted by numerous segments of the proposed transmission lines.

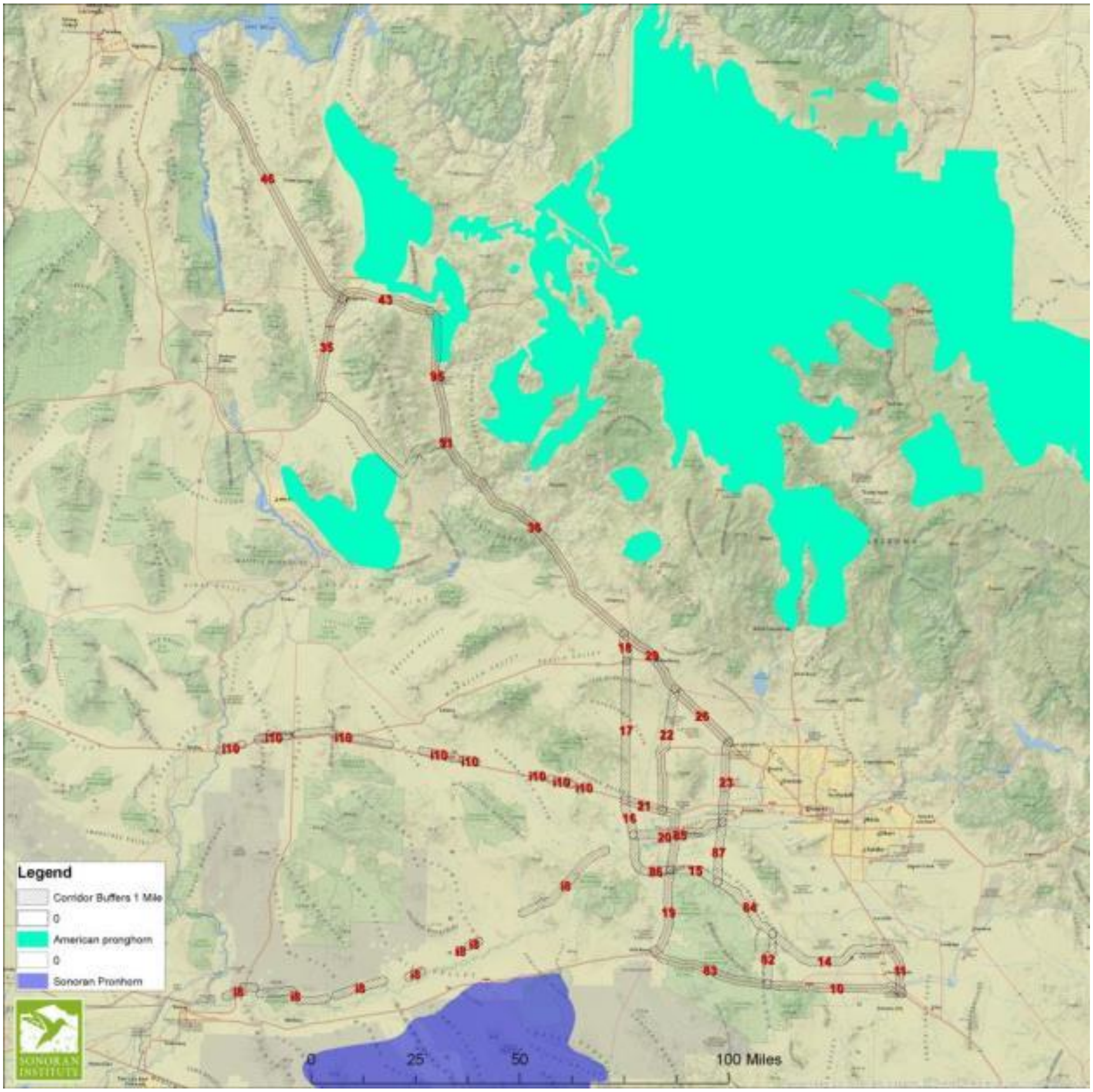

Figure 8: Sonoran pronghorn habitat does not overlap with the potential transmission lines, American pronghorn, on the other hand, does overlap.

Overlaps of Modeled Species Range with Route Segments (acres)

Segment Name/ ID	Segment Length (miles)	Western burrowing owl	Sonoran desert tortoise	Golden eagle	Gila monster	Gunnison prarie dog	Lowland leopard frog	Tucson shovel-nosed snake	Relict leopard frog	Northern leopard frog	Sprague's pipit	South-western willow flycatcher	Desert pupfish	Bony-tail chub	Yuma clapper rail	Razor-back sucker	American pronghorn	Lesser long-nosed bat	California leaf-nosed bat	Desert bighorn sheep	Kit fox
WWEC Segments in SW Arizona																					
I8 (WWEC 115-238)	62	5,458	58,593	1,588	92,720	-	46,595	-	-	-	5,546	-	-	-	1,205	-	-	-	86,064	14,490	93,456
I10 (WWEC 30-52)	48	10,487	66,903	12,147	77,890	-	-	-	-	-	216	-	-	-	0	-	-	-	66,954	15,117	76,770
I-11 Alternative Segments																					
10	33	20,742	29,638	22,440	29,492	-	-	5,636	-	-	-	-	-	-	0	-	-	17,343	24,623	5,724	33,947
11	12	5,802	2,497	5,253	2,434	-	-	1,721	-	-	-	-	-	-	9	-	-	807	3,933	-	6,726
14	32	9,771	18,199	7,902	18,244	-	-	6,335	-	-	-	-	-	-	13	-	-	3,531	16,880	945	22,029
15	12	165	16,905	164	16,896	-	8,768	-	-	-	210	-	-	-	-	-	-	189	17,130	-	17,135
16	12	184	10,620	-	10,624	-	9,987	-	-	-	219	-	-	-	1	-	-	202	10,668	-	10,668
17	33	11,982	39,852	-	39,874	-	2,602	-	-	-	330	161	-	-	1	-	-	77	40,067	-	40,098
18	7	-	7,501	-	7,829	-	-	-	-	-	-	286	-	-	-	-	-	-	7,506	-	7,834
19	21	-	21,663	-	21,520	-	24,307	-	-	-	3,137	-	-	-	28	-	-	1,557	21,572	-	21,523
20	17	2,235	10,281	-	11,589	-	15,581	-	-	-	6,065	37	-	-	2,218	-	-	2,892	8,499	560	11,042
21	9	747	10,495	-	10,437	-	4,430	-	-	-	-	100	-	-	1	-	-	131	9,403	-	11,349
22	30	-	36,588	373	36,613	-	-	-	-	-	173	518	-	-	2	-	-	134	33,044	-	36,877
23	20	5,244	2,107	213	2,178	-	24,706	1,890	-	-	1,358	-	-	-	512	-	-	18	505	-	2,182
26	22	1,131	20,224	8,008	20,378	-	3,026	1,886	-	-	-	17	-	-	1	-	-	-	18,644	-	20,211
29	26	-	20,926	12,140	22,245	-	14,999	-	-	-	-	2,342	225	225	-	225	-	-	22,145	-	21,577
35	25	4,893	26,908	6,519	27,249	-	-	-	-	-	-	-	-	-	-	-	-	-	2,128	-	27,249
36	65	3,104	67,706	64,061	82,913	-	65,648	-	-	-	-	4,012	84	-	-	-	-	-	62,131	-	79,266
43	23	13,715	848	25,186	25,470	513	8,224	-	-	19,808	-	-	-	-	-	-	-	-	6,511	-	24,631
46	70	10,348	71,935	28,530	82,191	-	-	-	19,750	-	-	-	-	-	2	-	-	-	29,440	-	85,069
82	13	711	12,833	2,180	12,900	-	-	-	-	-	8	-	-	-	9	-	-	1,643	12,936	832	12,921
83	29	-	33,307	4,111	33,363	-	8,977	-	-	-	3	-	-	-	-	-	-	17,462	33,384	1,529	33,373
84	19	207	20,435	492	20,437	-	-	-	-	-	1,954	-	-	-	21	-	-	144	20,487	-	20,471
85	23	1,171	4,289	127	6,248	-	15,606	-	-	-	14,001	1,273	-	-	4,139	-	-	319	5,102	-	4,960
86	16	536	11,360	-	12,979	-	13,152	-	-	-	3,641	-	-	-	2,330	-	-	1,666	12,143	2,239	12,035
87	14	2,936	8,308	414	8,822	-	7,071	-	-	-	5,179	-	-	-	1,270	-	-	1,847	8,796	-	9,051
91	42	-	43,494	39,357	49,938	-	10,279	-	-	-	351	390	-	-	-	-	954	-	32,710	-	49,956
95	32	-	34,178	31,843	37,743	-	39,342	-	-	-	-	932	-	-	-	-	12,855	-	38,455	-	38,378

Analyzed but no range recorded in buffers: Springerville pocket mouse, Sonoran pronghorn, Mohave fringed lizard, Chiricahua leopard frog, Humpback chub, Sonora Chub, California least tern, Mexican spotted owl, Gila chub, Spikedace, Loach minnow.

Small range recorded in buffers, appears to be a modeling error: black footed-ferret, Gunnison's prairie dog.

368corridors, BLM_WO <blm_wo_368corridors@blm.gov>

Federal West-Wide Energy Corridors, Comments on Review

2 messages

Evie Wilson Fri, May 23, 2014 at 3:28 PM
To: "368corridors@blm.gov" <368corridors@blm.gov>

Attached please find my comments on the subject corridors, as requested by your Interagency Workgroup. I understand comments close 5/27/14. Evie Wilson, 5641 Meadow Lane, Mariposa CA 95338.

Federal West.docx
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368corridors, BLM_WO <blm_wo_368corridors@blm.gov> Tue, May 27, 2014 at 2:16 PM
To: Evie Wilson

Ms. Wilson,

Thank you for your recent feedback regarding the energy corridors request for information.

regards,

On Fri, May 23, 2014 at 3:28 PM, Evie Wilson wrote:

> Attached please find my comments on the subject corridors, as requested by your Interagency Workgroup. I understand comments close 5/27/14. Evie Wilson, 5641 Meadow Lane, Mariposa CA 95338.

Federal West-Wide Energy Corridor Comments, 5/23/14 (Close 5/27/14)
To: Bureau of Land Management, 368corridors@blm.gov
From: Evie Wilson,

I'm writing in OPPOSITION to the huge (often five miles wide) corridors for wind and solar facilities being planned for Energy Corridor upgrades across our desert lands. I'm not opposed to upgrading our EC underground pipelines, as long as they don't close out **currently designated uses of our public lands:** grazing, mining, recreation and a myriad of other uses.

I'm opposed because huge wind/solar facilities would (and/or easily could):

- Destroy previously designated uses of public lands.
- Destroy habitat and kill birds, including "endangered species".
- Use huge amounts of scarce water, and could cause private wells to dry.
- Degrade nearby private property values.
- Destroy the beauty of the desert and tourist values.
- Leave a permanent, unsightly mess if abandoned.

The BLM, FS and Dept. of Energy designed these corridors with "stakeholder" input, but they chose their stakeholders with bias aforethought. Extremist, special interest groups had influence in the planning process, but not the counties, other local governments, and not mining, grazing, recreation and many other very interested groups of "stakeholders".

Also, solar technology has not advanced very much, huge facilities cost too much to make a profit, and companies depend on government assistance to stay afloat. If built on public land and then abandoned, the government would have to fund it, clean up the mess, or leave it as a blight. Solar and wind facilities have not yet been proven to be viable, and should NOT be built on public lands.

These facilities should be built on private lands with private funding. Then there's a better chance that they won't be abandoned for the taxpayer to take the loss. Even the extremist groups that sued and forced the EC focus on solar and wind, faced with the reality of their actions—huge facilities that destroy habitat and kill endangered species—are now threatening to sue again, to STOP them!

In conclusion, the solar and wind facilities, that huge amounts of public money has already been spent (wasted) on, should not be built on public lands. The Revision of the ECs to focus on large-scale solar and wind facilities is arbitrary, impractical, unnecessary and contrary to the public interest. I urge you to upgrade only the oil, gas and hydrogen pipelines, and abandon plans for alternative energy on public lands.

Sincerely, Evie Wilson, 5641 Meadow Lane, Mariposa CA 95338

SAN MIGUEL COUNTY

BOARD OF COMMISSIONERS

ELAINE FISCHER ART GOODTIMES JOAN MAY

SUBMITTED VIA EMAIL TO: 368corridors@blm.gov

May 23, 2014

DEPARTMENT OF THE INTERIOR – Bureau of Land Management ("BLM")
Attn. Michael D. Nedd, Asst. Dir., Energy, Minerals, and Realty Management
DEPARTMENT OF AGRICULTURE – Forest Service ("FS")
Attn. Tony L. Tooke, Asst. Deputy Chief – National Forest System
DEPARTMENT OF ENERGY – Office of Electricity Delivery and Energy Reliability
Attn. Matt Rosenbaum, Acting Dir., National Electricity Delivery

Request for Information: West-Wide Energy Corridor Review
Comments of San Miguel County, Colorado

Dear Messrs Nedd, Tooke, and Rosenbaum:

The San Miguel County, Colorado, Board of Commissioners ("BOCC") appreciates the opportunity to provide comments regarding the multi-agency Request for Information pertaining to the West-Wide Energy Corridor Review. For the past several years San Miguel County has participated in both the federal agency administrative processes and related litigation in federal court regarding the federal agencies' West-Wide Energy Corridor ("WWEC") designation process. The County participated in the litigation settlement process that resulted in the agreement that received federal court approval on July 11, 2012. The multi-agency Request for Information, published in the Federal Register on March 28, 2014, represents an appropriate step toward implementation of the court approved settlement.

As you are aware, WWEC corridor sections 130-274 and 130-274(E) are located in San Miguel County. The 2012 settlement agreement designates those corridors as corridors of concern. While portions of those corridors are located on federal public lands under BLM and FS jurisdiction, those corridor sections are connected by private and state lands that are under the county's jurisdiction. During the federal agency WWEC designation process the BOCC expressed its serious concerns over its apparent inability to provide meaningful input regarding the impact the proposed corridor designations could have on those privately owned parcels of land within the county that are located between the federal lands that were designated as part of the WWEC system.

The BOCC has had the opportunity to review The Wilderness Society's "Recommendations Related to the Request for Information: West-wide Energy Corridors Review," dated May 27, 2014, submitted by Alex Daue, Assistant Director, Renewable Energy. The BOCC hereby adopts and endorses The Wilderness Society's Recommendations of May 27, 2014, both as they apply to the WWEC designations within San Miguel County and those corridors located outside

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www.sanmiguelcounty.org

the county. We specifically support and endorse the recommendation that "The BLM and USFS should extend its environmental assessment of existing corridors to non-federal lands, including private and state trust lands" and that the affected local governments have the opportunity to provide meaningful and timely input into the federal NEPA process. San Miguel County looks forward to working cooperatively with the various federal agencies involved in the WWEC implementation process.

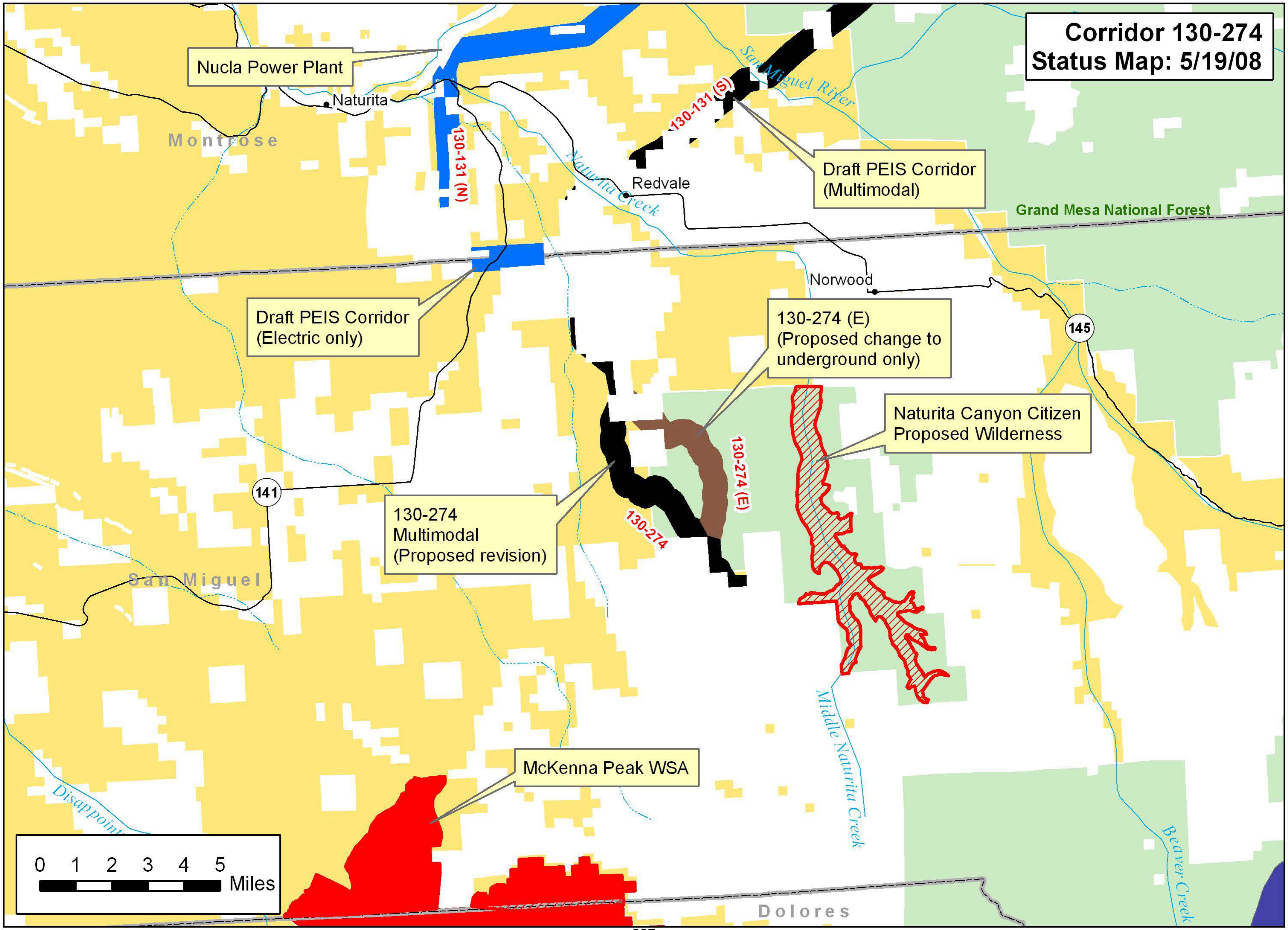
Respectfully submitted:

SAN MIGUEL COUNTY, COLORADO
BOARD OF COUNTY COMMISSIONERS

Art Goodtimes, Chair

Cc: Senators Bennet, Udall, Representative Tipton, BLM SW Colorado District Office

Ongoing Work by Federal Agencies on Potential Energy Corridors in the Western States
Draft - Subject to Change



BLM Request for Information

West-Wide Energy Corridor Review

On March 28, 2014, a notice was published in the Federal Register[1] announcing a Request for Information (RFI) soliciting information that will assist the Agencies in the development of the Section 368 Corridors Study. Specifically, the RFI asks:

1.) Are there any new or updated data that is publicly available that may be used to inform the 368 Corridor Study?

2.) Are there any other types of projects (beyond those identified in the EPAct) that the Agencies should consider to assess use of Section 368 Corridors?

3.) Are there methods the Agencies should consider using to evaluate the effectiveness of the IOPs (mandatory Interagency Operating Procedures adopted for projects sited within Section 368 Corridors)?

On July 7, 2013, the Agencies created a process for conducting Regional Periodic Reviews. These reviews will consider:

- New Relevant Information. In general, the Agencies will consider significant regional energy development and corridor and transmission plans or studies, which are supplemented by project-specific studies that were completed after January, 2009 or that are substantially underway.

- Identification of New Requirements. This would include any laws, regulations or other requirements that have been implemented since January 2009 that the Agencies should consider.

- Identification of Regional Stakeholder Fora. The Agencies have identified an initial list of existing regional stakeholder for a including WECC.

- Changes to IPPs and comments on new IOPs.

WECC would like to make BLM aware of the following information related to its RFI:

1. 2013 WECC Interconnection-wide Transmission Plan

[1] Request for Information: West-Wide Energy Corridor Review, *Federal Register*, Vol. 79, No. 60, March 28, 2014

In 2013, WECC completed its first Interconnection-wide Transmission Plan that included planning analysis and recommendations in both the 10-year and 20-year planning horizons. The Plan Summary identified observations in both the 10-year and 20-year planning horizons and identified Emerging Issues in reliability, variable generation, environmental factors and risk. It also identified nine key recommendations:

1.) Modest changes in natural gas prices, CO_2 prices or penalties and technology costs may result in significantly different future optimal generation resource mixes, and thus, different transmission needs. This is especially true beyond the 10-year timeframe, which creates both risk and opportunity. Due to the uncertainty across these three key drivers, WECC recommends that all *applicable* planning studies (or efforts) include sensitivities of these factors.

2.) Decision makers may want to investigate strategies that can protect against the inherent risk posed by the uncertainty associated with gas prices, CO2 and other environmental costs or constraints, and technology advances. Three important categories of hedging strategies include transmission investment, demand-side measures (efficiency and demand response), and distributed renewable generation. Based on results observed in TEPPC studies, WECC recommends that energy efficiency/demand response/distributed generation programs and transmission expansion be evaluated as potential hedges against the uncertainty posed by gas pricing, CO2 costs and technology costs. Furthermore, hedging against uncertainty and delay for siting large projects may be addressed by securing and maintaining permits for large interregional transmission projects, by gaining better information regarding transmission siting obstacles and identifying desirable transmission corridors, and by appropriate incorporation of “distributed” (EE and DG) strategies.

3.) Both 10- and 20-year studies suggest that peak-demand growth will be modest and there will be adequate resources to serve peak demand. However, the increase in VG during the same timeframes highlights the need for flexible resources, or other sources of operational flexibility. WECC recommends that planners and others attempt to develop more comprehensive, accurate and detailed assessments of flexibility needs and of operational and infrastructure investment approaches to providing flexibility. This includes developing practical methods for measuring the flexibility implications of alternative infrastructure investment strategies and for determining where the flexibility risk threshold lies. It also includes giving adequate consideration to the benefits of geographic diversity of variable resources, as well as efficient operational and investment strategies to utilize this diversity. A forward-looking assessment should consider not only conventional sources of flexibility (e.g., gas combustion turbines) but also less conventional sources such as market and operational reforms, demand-side measures and non-conventional storage.

4.) Recent progress has been made in evaluating the gas-electric interface and the risk to reliability it may pose for the Western Interconnection. Many of these studies have created the framework for additional analysis that is needed to quantify the risks and vulnerabilities faced by the bulk power system regarding this issue. WECC recommends that TEPPC perform such a study during one of its upcoming study cycles. The study should build upon current Western Gas-Electric Interface study efforts, such as the SPSC study currently under way. The specific scope and goal of the study will be defined by TEPPC at a later date.

5.) Many observations and recommendations in the 2013 Plan are related to future uncertainty with regard to gas prices, technology costs, carbon prices and even transmission assumptions in datasets. Other key uncertainties involve environmental siting costs and hurdles, and the minimum threshold requirements (and costs) for system flexibility, especially for scenarios having high wind/solar penetration. WECC recommends that TEPPC and other planners attempt to further quantify or bound these key uncertainties and provide that information to stakeholders for external use.

6.) Compensatory mitigation costs are one tool for rectifying adverse environmental effects of building new transmission after avoiding and minimizing effects to the extent possible. WECC recommends that TEPPC consider the use of analytical results from ongoing Environmental Data Task Force (EDTF) work. These results may guide discussions and decisions as TEPPC considers the use of mitigation costs as a component of transmission capital costs (and for selecting optimal corridors) when creating transmission expansion plans. This feeds into the assessment and management of risks associated with environmental siting, as previously mentioned.

7.) WECC has used the new LTPT to optimally derive feasible network expansions necessary to meet the load and generation requirements of future scenario study cases in the 20-year timeframe. To date, corridor identification has been limited to these electrical network expansions. However, one of the strengths of the LTPT is its ability to take into consideration environmental costs and risks in identifying corridors that are considered to be least-risk paths based on environmental data. WECC recommends that TEPPC consider using the LTPT to derive least-risk corridors between major load and generation hubs within the Western Interconnection, and provide the results of this analysis to stakeholders. These corridors could be identified regardless of LTPT-derived network expansions. The corridors connecting key resource and load hubs could be provided to project developers for more detailed analysis.

8.) TEPPC has made a number of improvements to its processes and analytical capabilities since the first WECC 10-Year Plan was released in 2011. However, even with these improvements, the need to improve planning analyses still remains. Stakeholders have provided many suggestions for ways that modeling might be improved based on results produced in the current TEPPC Study Cycle. WECC recommends that TEPPC undertake the work to improve a number of technical modeling issues, including investigating improvements to the 20-year LTPT Modeling approach. TEPPC should also embrace the opportunity to improve data quality and sharing practices. Many other planning processes rely on TEPPC data. One way for TEPPC to provide value to the

Interconnection is for this public data to be of high quality and readily available for stakeholder consumption.

9.) In both the 10- and 20-year studies, transmission additions identified as Common Case Transmission Assumptions were assumed built and included in the model. These projects are at various stages of development with varying degrees of certainty that they will be constructed. To account for the possibility that one or more of these projects are not constructed, WECC recommends that TEPPC consider performing sensitivities by individually removing key projects from the 2022 Common Case. WECC also recommends that others using the TEPPC dataset consider this sensitivity.

The complete Plan Summary is posted on the WECC web site, as are results of specific 10-year and 20-year planning studies, detailed descriptions of the Tools and Models used in the Plan, detailed descriptions of the Data and Assumptions used in the Plan, WECC Path Reports and several appendices supporting the Plan.

2. Preferred Environmental Data Sets and Environmental Data Viewer

In 2011, WECC published "Environmental Recommendations for Transmission Planning," a result of the first effort to identify environmental data relevant to the Western Interconnection and to recommend ways that it can be used in transmission expansion planning. Two of the critical elements of this report were:

1.) A set of environmental data that is preferred for use in transmission expansion planning. These data have been vetted through WECC's Data Quality Protocol, including review by a broad group of environmental, industry and governmental stakeholders. The preferred environmental data sets are available for public review and use on the WECC web site.

2.) A four-tiered risk classification system that identifies at the planning level the relative risk of encountering environmental sensitivities that a transmission developer may face for a potential transmission project.

The complete report "Environmental Recommendations for Transmission Planning" is available on the WECC web site.

In addition, WECC has posted on its web site a link to its Environmental Data Viewer. This tool allows any stakeholder to view any area within the Western Interconnection and identify the environmental risk classification for each portion of the area under consideration. This tool allows transmission developers, regulatory authorities, policy makers and any other stakeholders to identify the least-environmental-risk corridor for a potential transmission project.

3. Stakeholder Feedback on 368 Corridors

Both during an October, 2013 Western Governors' Association (WGA) Transmission Siting Task Force meeting in Portland and during developer interviews conducted by the EDTF, stakeholders have commented that attempting to develop transmission within designated corridors may not be significantly easier than outside of designated corridors. In addition, when DOI hosted a mitigation meeting in June, 2013, one of the main comments from stakeholders was that better inter-agency coordination is needed to expedite transmission siting.

4. Opportunities for Stakeholder Collaboration

WECC is committed to a transparent transmission expansion planning process. All of WECC's meetings are open to any interested stakeholder and all of its data, reports and study results are posted on the WECC web site for public review. Stakeholder groups involved with transmission expansion planning at WECC include:

- The Transmission Expansion Planning Policy Committee (TEPPC). TEPPC: 1) oversees and maintains a public database for production cost and related analysis; 2) develops and implements Interconnection-wide expansion planning processes in coordination with the Planning Coordination Committee, other WECC committees, Subregional Planning Groups (SPGs) and other stakeholders; 3) Guides and improves the economic analysis and modeling of the Western Interconnection and conduct transmission studies; and 4) Prepares Interconnection-wide transmission plans consistent with applicable NERC and WECC reliability standards.

- The Technical Advisory Subcommittee (TAS). TAS collects and disseminates data and study results for historic and forward-looking transmission expansion studies. Potential future congestion is evaluated using production cost simulation techniques in the 10-year study timeframe. TAS also conducts 20-year studies using WECC's Long-term Planning Tool. The Data, Modeling, and Studies Work Groups provide technical stakeholder input that is necessary for conducting these studies in a public environment.

- The Scenario Planning Steering Group (SPSG). The SPSG provides strategic guidance to the Transmission Expansion Planning Policy Committee (TEPPC) on: 1) scenarios to be modeled in transmission planning studies; 2) the modeling tools to be used; and 3) key assumptions to be used in creating and reviewing the scenarios. The scenarios created and/or recommended by the SPSG assist TEPPC in its evaluation of long-term transmission capacity needs in the Western Interconnection by providing a comprehensive set of plausible future load, resource, and policy states.

- The Environmental Data Task Force (EDTF). The EDTF was formed by the Scenario Planning Steering Group (SPSG) to develop recommendations on the type, quality, and sources of data on land, wildlife, cultural, historical, archaeological, and water resources. The EDTF was purposed with exploring ways to transform that data into a form usable in WECC's Transmission Expansion Planning study cases, 10-year, and long-term planning models.

Opportunities for stakeholders to participate in WECC's transmission planning processes are posted on the TEPPC Calendar.

For further information on WECC's transmission expansion planning activities, please contact Keegan Moyer, Manager of Transmission Expansion Planning at kmoyer@wecc.biz.

COALITION OF LOCAL GOVERNMENTS
925 SAGE AVENUE, SUITE 302
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COUNTY COMMISSIONS AND CONSERVATION DISTRICTS FOR LINCOLN, SWEETWATER, UINTA, AND SUBLETTE - WYOMING

May 27, 2014

Via sfusilie@blm.gov and 368corridors@blm.gov

Stephen L. Fusilier
Transmission and Energy Corridor Program Lead
20 M Street, SE
Washington, DC 20003

RE: Section 368 Energy Corridor Study Request for Information

Mr. Fusilier:

On March 28, 2014, the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM); U.S. Department of Agriculture, U.S. Forest Service (USFS); and the U.S. Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability, requested additional information regarding the West-Wide Energy Corridor Review (368 Review). The Request for Information covers two major subjects: (1) development of a Section 368 Corridor Study; and (2) preparation of regional periodic review of Section 368 corridors. To accomplish these tasks, BLM requests eight different types of information set out below.

The Coalition of Local Governments is particularly suited to comment on this request. The Coalition is a voluntary association of local governments organized under the laws of the State of Wyoming to educate, guide, and develop public land policy in the affected counties. Wyo. Stat. §§11-16-103, 11-16-122. Coalition members include Lincoln County, Sweetwater County, Uinta County, Sublette County, Lincoln County Conservation District, Sweetwater Conservation District, Uinta County Conservation District, Sublette County Conservation District, and Little Snake River Conservation District. The Coalition serves many purposes for its members, including the promotion of policies and land management that protect vested rights of individuals and industries dependent on utilizing and conserving existing resources and public lands, promotes and supports habitat improvement, supports and finds scientific studies addressing federal land use plans and projects, and providing comments on behalf of members for the educational benefit of those proposing federal land use plans and land use projects.

Both county and conservation district members of the Coalition have authority to protect the public health and welfare of Wyoming citizens while promoting and protecting public lands and natural resources. Wyo. Stat. §§18-5-102; Wyo. Stat. §§11-16-122. Given this broad statutory

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charge and wealth of experience in public land and natural resource matters, the Coalition has coordinated efforts with BLM, Bureau of Reclamation, U.S. Fish and Wildlife Service, USFS, Wyoming Department of Environmental Quality, and other federal, state, and local entities.

SUMMARY OF REQUESTED INFORMATION

The Federal Register notice requested the following classes of information and comments on the Interagency Operating Procedures (IOPs). The Coalition has identified and categorized this information as follows:

Category 1: GIS Data. Because the original corridors were designed with data available prior to 2009, the Coalition believes the information labeled as "Category 1" in the table below will affect the location of Section 368 Corridors.

Category 2: Types of Projects Considered. The Agencies are focused on 100kV and larger transmission projects, and oil, gas, and hydrogen pipelines 10 inches or more in diameter that have been authorized on Federal lands. The Coalition believes there are other types of projects that the Agencies should consider in assessing use of Section 368 Corridors, including wind energy transmission lines, labeled as "Category 2" in the table below.

Category 3: Method for Assessing Inter-Agency Operating Procedures (IOPs). The Agencies will assess the effectiveness of the IOPs in expediting the siting, permitting, and review process and are interested in receiving suggestions of methods for assessing the effectiveness of IOPs. This type of information is labeled "Category 3" in the table below.

Category 4: Additional Public Information. The Coalition believes there are several studies, reports, online tools, and other data that should be considered as part of the initial Regional Periodic Review of Section 368 Corridors labeled as "Category 4" in the table below.

Category 5: New Laws and Regulations That Affect Section 368 Corridors. The Coalition believes there are relevant laws, regulations, or other requirements that have been implemented after January 2009 that the Agencies should consider when reviewing Section 368 Corridors labeled as "Category 5" in the table below.

Category 6: Stakeholder Fora. The Coalition believes there are additional fora that could be considered for stakeholder engagement during Regional Periodic Reviews that are labeled as "Category 6" in the table below.

Category 7: IOP Modifications. The Coalition will comment on the IOPs separately.

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Using these categories, we have compiled a list of data, documents, events, plans, and other relevant information in the table below with the location of the document or the information to be used by the Agencies. Following the table is our discussion of the IOPs.

Information or Document	Location	Category
Sweetwater County Planning and Zoning Documents, Boards, GIS Maps, Stakeholder Fora	www.sweet.wy.us	1, 5 and 6
Sweetwater County Conservation District Land Use Plans	www.swccd.us	5 and 6
Uinta County Planning and Zoning Documents, Boards, Maps, and Stakeholder Fora	www.uintacounty.com	1,5 and 6
Lincoln County Planning and Zoning Documents, Boards, GIS Maps, Stakeholder Fora	www.lcwy.org	1,5 and 6
Lincoln County Conservation District land use plans and educational materials	www.lincolnconservationdistrict.org	4, 5 and 6
Sublette County Planning and Zoning	www.sublettewyo.com	1,5 and 6

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Information or Document	Location	Category
Documents, Boards, GIS Maps, Stakeholder Fora		
Carbon County Wyoming Planning and Zoning Documents, Boards, GIS Maps, Stakeholder Fora	www.carbonwy.com	1,5 and 6
Wyoming County Commissioners Association Stakeholder Fora	www.wyo-wcca.org	4
Wyoming Association of Conservation Districts -- Plans, Stakeholder Fora, Education	www.conservewy.com	4,5 and 6
Wyoming Game and Fish Statewide Wildlife Action Plan	http://wgfd.wyo.gov/wtest/wildlife-1000817.aspx	1, 4, 5 and 6
Rocky Mountain Institute	Critical Issues in Domestic Energy Vulnerability http://www.rmi.org/Knowledge-Center/Library/S01-25_CriticalIssuesDomesticEnergySecurity	4
Wyoming Weed and Pest Council	www.wyoweed.org	1,4,5 and 6
Wyoming State Executive Orders	www-wsl.state.wy.us/sis/wydocs/execorders.html	5
Wyoming Interagency Spatial Database & Online Management	http://wisdom.wygisc.org/	1

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Information or Document	Location	Category
System		
Wyoming Density and Disturbance Calculation Tool	http://ddct.wygisc.org/	1 and 4
Wyoming Areas of Critical Environmental Concern	http://www.geocommunicator.gov/geocomm/metadata/acec/acec_desig_poly.htm	1 and 4
BLM Wild Horse Management Documents and Settlement Agreement with RSGA	http://www.blm.gov/wy/st/en/programs/Wild_Horses.html	1, 4 and 5

INTERAGENCY OPERATING PROCEDURES: PLANNING

1. Government-to-Government Consultation

The Agencies must initiate government-to-government consultation with more than just "affected Tribes." The Agencies must consult and coordinate with local governments, including counties and conservation districts, to ensure that local land use plans, transportation plans, conservation and reclamation efforts, public land uses, and other unique issues are timely addressed. 43 U.S.C. §1712(a). "The IOPs are expected to reduce duplication, *increase coordination*, and ensure consistency among all participants in the permitting process." *BLM Record of Decision* at 16 (emphasis added). It is essential that corridor designations reflect private lands and land uses.

2. General

Applicants seeking to develop a project-specific Plan of Development should consult with local governments to insure that project infrastructure (i.e. towers, power lines) are placed in areas that do not conflict with existing uses, valid existing rights, private and state land uses, and sensitive wildlife habitat. Applicants must also work closely with local governments such as counties, conservation districts, and weed and pest districts to ensure that both short term and long term resource impacts are effectively mitigated and immediately reclaimed. The Agencies must analyze the synergistic relationship between Section 368 corridors and other projects that may increase cumulative impacts to the region.

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3. Transportation

The Agencies and the Applicant, in preparing an Access Road Siting and Management Plan and a Comprehensive Transportation Plan, must consult existing county transportation plans, local government transportation mapping layers, and plans developed by BLM or USFS with regards to other natural resource development projects (i.e. Jonah, Normally Pressurized Lance, Continental Divide-Creston, etc.). Similarly, the Agencies must follow those procedures identified in the relevant transportation handbooks (i.e. *BLM H-8342 Travel Management Handbook*). All access roads must be constructed in the most efficient manner possible to minimizing surface disturbance while increasing the chances of site stabilization, interim reclamation, and final reclamation. The federal agency needs to coordinate with local governments with regards to new roads or increased loads on existing roads.

4. Groundwater and Surface Water

The Agencies must comply with local watershed plans to ensure that valuable groundwater and surface water sources continue to support their designated uses under state and federal law. This would include surface runoff from construction on two-track roads.

5. Paleontological Resources

The Agencies and the Applicant must include paleontological resources as a Cultural Resource (discussed below) to be included and considered as part of the Cultural Resources Management Plan.

6. Ecological Resources

The Agencies must develop IOPs specifically dealing with Greater Sage-Grouse in Wyoming. The BLM has recently completed a DEIS regarding the SG-9 Plan in Wyoming and this plan was closely drafted from the Wyoming Greater Sage-Grouse Core Area Strategy as outlined in Wyoming Executive Order 2011-5 and its 2013 supplement. The Agencies must consult and coordinate not only with other federal agencies, but because of the state and local government's heavy involvement in developing the SG-9 Plan, the Agencies must also consult meaningfully with local counties, conservation districts, landowners and permittees when evaluating the location and on-the-ground circumstances of the corridors. Raptors use power lines to hunt sage-grouse, rangeland may be impacted by corridor disturbances, and other wildlife could potentially lose habitat. These, among other factors, need to be considered.

The Habitat Restoration Plan will necessarily have significant influence from the SG-9 Plan. Thus, it is important to immediately integrate the state and local entities that have worked on the SG-

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9 Plan and to ensure successful reclamation. Moreover, the Habitat Restoration Plan must also incorporate considerations of critical winter habitat, wild horse management areas and litigation documents surrounding the appropriate management levels for those wild horse populations, and the density of disturbance in these habitats.

7. Vegetation Management

The Integrated Vegetation Management Plan should closely mirror local land use plans developed by counties and conservation districts and be driven to meet Wyoming Standards for Healthy Rangelands and the SG-9 Plan. Local land use plans include specific directives regarding, but not limited to, noxious and invasive species and sensitive wildlife species. The Agencies, again, must require that Applicants and agency personnel work closely with local conservation districts, weed and pest districts, landowners, and on-the-ground experts to aggressively manage the presence and spread of noxious and invasive species.

8. Cultural Resources

The Agencies and the Applicant must, in developing the Cultural Resources Management Plan and the Historic Property Treatment Plan, first work with Tribes, local governments, counties, and other affected parties to establish a baseline inventory and to establish a protocol in the event that new cultural resources are located after corridors have been identified.

With respect to historic sites or trails, any protection must conform to National Park Service eligibility criteria, particularly visibility and integrity. In the Gateway West project, BLM altered the route to avoid a trail even though all vestiges of the affected trail segment were no longer visible. The reroute interfered with private land values and land uses.

9. Visual Resources

The Agencies and the Applicant must, in preparing a VRM or Scenery Management Plan, consult with counties and conservation districts in order to ensure that VRM changes conform to land use classifications and are accurate and ground truthed (i.e. features must actually be visible, not merely documented). Historic trails are often included as justifications for a VRM classification when the affected trail segment no longer exists.

10. Public Health and Safety

The Public Health and Safety Program must be integrated with local governments, special districts, first responders and other public safety authorities. The program should identify major risks, threats, and vulnerabilities and the protocol to be followed in the case of an emergency.

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11. Hazardous Materials Management

Spills of hazardous materials implicate a vast range of natural and human resources. Thus, the Spill Prevention and Response Plan must be developed after ample consultation with counties, operators, and soil and water conservation districts.

12. Fire Management

The Fire Management Strategy must be developed hand-in-hand with local conservation districts and stakeholders in the SG-9 Plan. The Applicant may not "reduce hazardous fuels" without first evaluating sage-grouse and wildlife habitat, impacts on current land uses, existing surface disturbance calculations, the possibility that invasive and noxious species will invade the area, and other concerns that will depend on the unique circumstances of the particular corridor. Similarly, activities must be modified to avoid fire.

INTERAGENCY OPERATING PROCEDURES: CONSTRUCTION AND OPERATION

1. General

Construction of Section 368 corridors may impact the Density Disturbance Calculation with regards to Greater Sage-Grouse pursuant to the SG-9 Plan. Thus, the Agencies must consult with local governments and ensure that the minimal amount of surface is disturbed, for the shortest amount of time possible, using the least invasive construction methods.

2. Soils, Excavation, and Blasting

Suitable and non-suitable soils must be stored to: (1) minimize the total area of surface disturbance; and (2) maintain the biological health and structure of the soil. Thus, the Applicant and the Agencies must consult with local governments to determine best practices for accomplishing these two goals while increasing the likelihood of reclamation success. Sterile non-native seed mixes must be allowed during site stabilization, interim reclamation, and final reclamation efforts in order to prevent invasive and noxious species. Site stabilization should begin immediately with interim reclamation and final reclamation succeeding without any gap between these stages.

Explosives and other "noisy activities" need to be coordinated with the counties and its citizens to comply with noise regulations and ordinances as well as noise restrictions with regards to the SG-9 plan. The soils and vegetation found in Wyoming typically require years to regrow. Thus any route selected should also consider soil types and reclamation potential.

3. Mitigation and Monitoring

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The Applicant and the Agencies must coordinate and work closely with local governments in order to quickly stabilize disturbed sites and immediately implement successive reclamation efforts. Each site will include unique circumstances such as soil type, precipitation, vegetative objectives, rangeland standards, and wildlife habitat that need to be addressed. The Decommissioning Plan and the Site Reclamation Plan must include pre-construction, construction, operation and post-construction measures that ensure the site will be successfully reclaimed such as native and sterile non-native seed mixes, irrigation, soil storage and site planning, and site stabilization.

4. Surface and Groundwater Resources

To prevent dewatering of groundwater or wetlands and erosion, Applicants should establish a baseline inventory of these characteristics prior to excavating or drilling in an area by consulting with local conservation districts and related consultants. Streams are monitored for water quality by the Wyoming Department of Environmental Quality as well as local conservation districts and therefore can provide essential insight into reducing the likelihood erosion and pollution of important streams.

5. Ecological Resources

As mentioned earlier, the SG-9 plan is an essential piece of the regulatory scheme that must be acknowledged and used to determine appropriate actions with regards to energy corridors. Sensitive habitats are well mapped and can be directly *and* indirectly impacted by energy corridors. Surface disturbance, noise disturbance, and human activity all need to be tailored to the SG-9 Plan in close coordination with the stakeholders in that plan including local governments such as the Coalition. Similarly, other resources deserve equal protections such as rangeland use, wildlife habitat, and valid existing rights regarding other natural resources and projects.

6. Visual Resources

A pre-construction meeting with BLM, USFS, *and* local governments is essential in order to ground truth VRM classifications. Moreover, when contour grading and reclaiming disturbed sites, Applicants must stay within the established boundary of the disturbed area and may not increase the disturbed area to enhance the visual resource without first consulting with BLM, USFS and local governments.

7. Noise

"Noisy construction activities" needs to be defined and tailored to meet the SG-9 Plan.

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CONCLUSION

The IOPs need to be revised in order to facilitate increased coordination between all of the relevant stakeholders. As indicated by our table above, significant procedural and substantive data will change how the IOPs are implemented on a project or local scale. Thus, drafting the IOPs without regards to these local considerations will leave significant room for interpretation and error. To combat broadly drafted IOPs, the Agencies must consult and coordinate with local governments to the maximum extent possible in every phase: planning, construction, operation, and decommissioning. This will increase success and decrease conflicts in every aspect of the corridor study.

Sincerely,

/s/ Kent Connelly, Chairman
Coalition of Local Governments

cc: Wyoming Governor's Office
Wyoming Congressional Delegation
Wyoming Game and Fish
Wyoming State Lands
Wyoming Department of Agriculture

Date: May 27, 2014

Michael D. Nedd,
Assistant Director, Energy, Minerals, and
Realty Management, Bureau of Land
Management, U.S. Department of the Interior

Tony L. Tooke,
Associate Deputy Chief, National Forest
System, U.S. Forest Service, U.S. Department of Agriculture

Matt Rosenbaum,
Acting Director National Electricity Delivery,
Office of Electricity Delivery and Energy
Reliability, U.S. Department of Energy

Subject: Request for Information: West-Wide Energy Corridor Review

To Whom it May Concern:

The Wyoming Infrastructure Authority (WIA) submits these comments electronically to 368corridors@blm.gov in response to the Request for Information (RFI) published in the Federal Register on March 28, 2014. We are pleased that the agencies are conducting a much-needed review of the current 368 corridors in Wyoming. The current 368 pipeline corridors have some value, particularly where they have been integrated into resource management plan updates; however, the currently designated electric transmission line 368 corridors in western Wyoming are inadequate; have little value to actual transmission routing; are not being utilized by project proponents in the state; and have been used by federal regulatory agencies and others to argue against more reasonable routing alternatives.

Wyoming has tremendous potential for renewable energy. However, after several years of extensive analysis, federal agencies have yet to define an acceptable path for delivering these resources to western load centers. We continue to experience federal land management agencies push projects away from federal lands without considering the overall consequences to private landowners or project viability. Examples include the ongoing debate regarding routing of the Gateway West Transmission Line through the BLM's Kemmerer Field Office and Birds of Prey National Conservation Area in Idaho. The 368 corridor designations need to fix these problems.

Specifically in Wyoming we believe the review team needs to:

1. Abandon the current 368 transmission corridor from the Jim Bridger Power Plant to the west that follows Interstate 80, and
2. Work with the states of Wyoming and Idaho, local governments, industry, landowners, the Bureau of Land Management (Kemmerer Field Office), U.S. Fish and Wildlife Service (Cokeville Meadows National Wildlife Refuge) and National Park Service (Fossil Buttes National Monument) to find and designate an acceptable 368 corridor between the Jim Bridger Power Plant and Populus and Midpoint, Idaho.
3. In addition to the problems west of the Jim Bridger Power Plant, the current designated 368 corridor in the BLM's Rawlins Field Office crosses through the town of Fort Steele, Wyoming and adversely affects a number of residences and cultural resource properties. The 368 corridor for electric transmission lines in this are needs to be revised following the final route selected for the Gateway West transmission line.

4. Recognize the general value of co-locating new transmission lines with existing transmission lines regardless of land use designation or plan prescriptions and address WECC spacing requirements as a means of reducing overall environmental and private landowner impacts.

Identification of New Requirements: Subsequent to the initial 368 corridor designation, Wyoming addressed sage grouse conservation through a series of Governor executive orders (EO) and designation of sage grouse core areas. These EOs provided specific routing criteria for transmission lines through sage grouse core areas in the state. Some of the current designated 368 corridors are inconsistent with provisions of the EOs. These inconsistencies need to be addressed by the review team. The current EO and shapefiles of core areas can be found at http://wgfd.wyo.gov/wtest/wildlife-1000817.aspx.

Identification of Regional Stakeholders: Please include the Wyoming Governor's Office and local governments in your list of regional stakeholders.

Thank you for the opportunity to comment.

Kind Regards,

Loyd Drain
Wyoming Infrastructure Authority
200 East 17th Street, Suite B
Cheyenne, WY 82001
Loyd.Drain@wyo.gov

May 27, 2014

Michael D. Nedd
Assistant Director
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Tony L. Tooke
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National Forest System
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U.S. Department of Agriculture

Matt Rosenbaum
Acting Director
National Electricity Delivery
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

Via email to 368corridors@blm.gov

Dear Mssrs. Nedd, Tooke, and Rosenbaum:

The following are the comments of WildEarth Guardians on the request for additional information regarding westwide energy corridors pursuant to Section 368 of the Energy Policy Act.

Pipelines and transmission lines have fundamentally different types of environmental impacts. While both types of corridors are likely to become dispersal corridors for noxious weeds, overhead transmission lines also serve as raptor perching sites, increasing predation along the line corridors and potentially displacing prey species (notably sage grouse) from habitats adjacent to the line corridor. Thus, the Energy Corridors that include the potential for overhead transmission lines must be chosen with great care.

Minimizing Impacts of Energy Corridors

There are a great many sensitive lands and habitats that are potentially traversed by pipelines and powerlines. These include sensitive wildlife habitats such as sage grouse Priority Area for Conservation identified by the U.S. Fish and Wildlife Service (USFWS); Critical Habitats for

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Endangered and Threatened Species identified by USFWS; designated wilderness areas, Wilderness Study Areas, Inventoried Roadless Areas, and Lands with Wilderness Characteristics identified by Congress or federal agencies; and National Parks and Monuments and their neighboring viewsheds. We encourage you to consider these areas 'exclusion zones' for the purpose of energy corridor location. Other sensitive lands include habitats of federal or state sensitive species; crucial big game winter ranges, parturition areas, migration corridors identified by state game and fish agencies; private lands protected under conservation easements to protect key wildlife habitats; and viewsheds of important recreational lands, and we encourage you to treat these areas as 'avoidance zones' for the purpose of energy corridor location.

Several GIS-based reports address specific areas where transmission lines should be avoided or excluded, and we have attached these reports to these comments so that the information contained therein can inform any adjustments that might be made to energy corridor locations. In Wyoming, *Wind Power in Wyoming: Doing it Smart from the Start* catalogs avoidance areas and best management practices for a variety of sensitive lands and wildlife. See Attachment 1. In Montana, *An Ecological Risk Assessment of Wind Energy Development in Montana* identifies the distribution of sensitive resources that are potentially impacted by wind farms, and its findings are equally applicable to transmission line development. See Attachment 2. For Oregon, *Oregon's High Desert and Wind Energy: Opportunities for Responsible Development* addresses both wind power and transmission lines. See Attachment 3. Please consider the spatially explicit recommendations of these reports if and when adjustments are made to energy corridor locations.

As noted in the *Smart from the Start* wind power report, the southeastern corner of Wyoming has outstanding opportunities for wind power generation and few if any environmental conflicts. The absence of a designated energy corridor running southward from this region is troubling. We recommend that through the West-Wide Energy Corridors process, transmission lines running south from this region and thereby avoiding the prime sage grouse habitats farther west be prioritized and incentivized for construction, to bring renewable energy to market with the least amount of environmental impact.

Accounting for Science-Based Core-and-Corridor Ecoregional Plans

Under the Spine of the Continent/Western Wildway series of ecosystem reserve networks, core habitats for conservation and connecting corridors have been identified using SITES and other GIS-based modeling approaches to identify the most important remaining habitats on an ecoregional scale (see Attachments 4, 5). These models represent the best effort yet at providing connectivity at the regional and continental scales, providing latitudinal and altitudinal connectivity that enhances ecological resilience in the face of a changing climate. Thus, when habitats and species distributions need to shift as a result of appropriate habitats shifting northward, upward from an altitude perspective, or geographically according to shifting rainfall patterns, the protection of this system of cores and corridors best ensures the habitat connectivity that would allow wildlife populations to successfully shift to meet the shifting distribution of their required habitats.

West-Wide Energy Corridors should not be sited in Core Areas under these ecoregional plans, and should cross connecting corridors at locations that result in the least possible impact.

Maintaining Existing Low-Impact Corridors

In some cases, the Westwide Energy Corridors follow pathways of relatively low environmental impact, while new proposals for major transmission lines have deviated from these designated corridors in favor of alignments with radically higher environmental impacts. In such cases, it is critically important that the Westwide Energy Corridors remain in their current, low-impact locations, and not be moved to accommodate higher-impact proposals.

This issue is embodied in the proposals for the Gateway South and TransWest Express transmission lines, which propose routes that traverse the highly sensitive Powder Rim instead of following designated Energy Corridors along Wyoming Highway 789, which would result in radically lower environmental impacts. Instead, the proposed line routings would traverse sensitive migration corridors of elk and mule deer bound for Powder Rim winter ranges, and impose habitat fragmentation in a relatively natural landscape that includes one of Wyoming's largest juniper woodlands, home to numerous species of juniper obligate songbirds that are rare in the state. In this case, the transmission corridor already established should remain along Highway 789, at most shifted west a few miles to occupy lands behind the rims and thus invisible from most private lands along the Muddy Creek valley, and the transmission lines should be required to shift to the designated energy corridor. Under no circumstances should the Energy Corridor be shifted to traverse the sensitive wildlife habitats of the Powder Rim.

Greater and Gunnison Sage Grouse Concerns

As you are no doubt aware, the decline of the greater and Gunnison sage grouse populations has led these species to the brink of listing under the Endangered Species Act. Transmission lines have been recognized as a serious threat to both of these species by the USFWS and others (see, e.g., Manier et al. 2013, Attachment 6), based on scientific studies that indicate increased avian predator activity around transmission lines and also behavioral avoidance of transmission lines by grouse, which tend to avoid tall structures of all types. Nonne et al. (2011, Attachment 7) found that raven abundance increased along the Falcon-Gondor powerline corridor in Nevada both during the construction period, and long-term after powerline construction activities had ceased. Braun et al. (2002, Attachment 8) reported that 40 leks with a power line within 0.25 mile of the lek site had significantly slower population growth rates than unaffected leks, which was attributed to increased raptor predation. Simply requiring perch inhibitors to be installed on powerlines is not an adequate regulatory mechanism; such perch deterrents reduce, but do not eliminate, raptor perching (Slater and Smith 2010, Attachment 9). Notably, it was golden eagles and ravens, two of the most important sage grouse predators and nest predators, respectively, that most effectively circumvented powerline perch inhibitors in this last study.

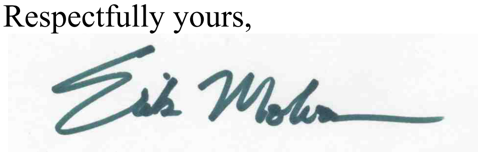
The Bureau of Land Management and USDA Forest Service are currently revising land-use plans across the range of the greater sage grouse to ameliorate the "inadequacy of regulatory mechanisms" identified by USFWS as a threat to the species in that agency's 2010 listing Rule. The BLM will soon be undertaking the same process for the Gunnison sage grouse. For the Gunnison sage grouse, proposed Critical Habitat has been proposed; for the greater sage grouse, the USFWS Conservation Objectives Team (Attachment 10) has identified Priority Areas for

Conservation ("PACs"). In the context of the land-use plan amendments for greater sage grouse, these PACs will be designated as Priority Habitats, and under each land-use plan these are to be managed as either avoidance or exclusion areas for overhead transmission lines. The BLM's own expert panel has recommended that Priority Habitats be managed as exclusion areas for overhead powerlines of all types (NTT 2011, Attachment 11). With these realities in mind, West-Wide Energy Corridors (particularly those involving overhead transmission lines) must be routed around Priority Habitats.

Conclusions

We support a West-Wide Energy Corridor network that minimizes impacts to sensitive lands and wildlife, that increases environmentally responsible renewable energy generation, and supports the growth of distributed renewable power generation. We call upon your agencies to further improve and refine the West-Wide Energy Corridor system to help the nation transition from its fossil fuel past to its renewable energy future, in a manner that minimizes the environmental consequences for lands and wildlife. Thank you for the opportunity to comment, and please keep us apprised of all future opportunities to participate in this process.

Respectfully yours,



Erik Molvar

<u>List of Attachments</u>

1. Wind Power in Wyoming: Doing it Smart from the Start
2. An Ecological Risk Assessment of Wind Energy Development in Montana
3. Oregon's High Desert and Wind Energy: Opportunities for Responsible Development
4. Spine of the Continent/Western Wildway map
5. Heart of the West ecoregional conservation plan map
6. Manier, D.J., Wood, D.J.A., Bowen, Z.H., Donovan, R.M., Holloran, M.J., Juliusson, L.M., Mayne, K.S., Oyler-McCance, S.J., Quamen, F.R., Saher, D.J., and Titolo, A.J. 2013. Summary of science, activities, programs, and policies that influence the rangewide conservation of Greater Sage-Grouse (*Centrocercus urophasianus*): U.S. Geological Survey Open-File Report 2013–1098, 170 p., http://pubs.usgs.gov/of/2013/1098/.
7. Nonne, D., E. Blomberg, and J. Sedinger. 2011. Dynamics of greater sage-grouse (*Centrocercus urophasianus*) populations in response to transmission lines in central Nevada. Progress Report: Year 9. Unpublished report, 55 pp.
8. Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and gas development in western North America: effects on sagebrush steppe avifauna with particular emphasis on sage grouse. In Transactions North American Wildlife and Natural Resources Conference 67:337-349.
9. Slater, S.J., and J.P. Smith. 2010. Effectiveness of raptor perch deterrents on an electrical transmission line in southwestern Wyoming. J. Wildl. Manage. 74: 1080-1088.

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11. Sage-grouse National Technical Team. 2011. A Report on National Greater Sage-grouse Conservation Measures. BLM report available at www.blm.gov/pgdata/etc/medialib/blm/co/programs/wildlife.Par.73607.File.dat/GrSG%20Tech%20Team%20Report.pdf.

Wind Power in Wyoming:

Doing it Smart from the Start

Biodiversity Conservation Alliance
Working to protect wildlife and wild places.
voiceforthewild.org

WWF

Wyoming Wilderness Association

Western Environmental Law Center

WILD UTAH PROJECT

EARTHFRIENDS WILDLIFE FOUNDATION

Californians for Western Wilderness

SIERRA CLUB FOUNDED 1892

Wind Power in Wyoming: Doing it Smart from the Start

November 2008

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Biodiversity Conservation Alliance is a nonprofit conservation organization working to protect wildlife and wild places in Wyoming and surrounding states.

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Front Cover Photographs: Wind towers near Medicine Bow, Biodiversity Conservation Alliance photo
Recreationist at Joe Hay Rim, Jack Morrow Hills by Biodiversity Conservation Alliance
Sage Grouse U.S. Geological Survey Image, Elk by Steve Torbit

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Acknowledgments

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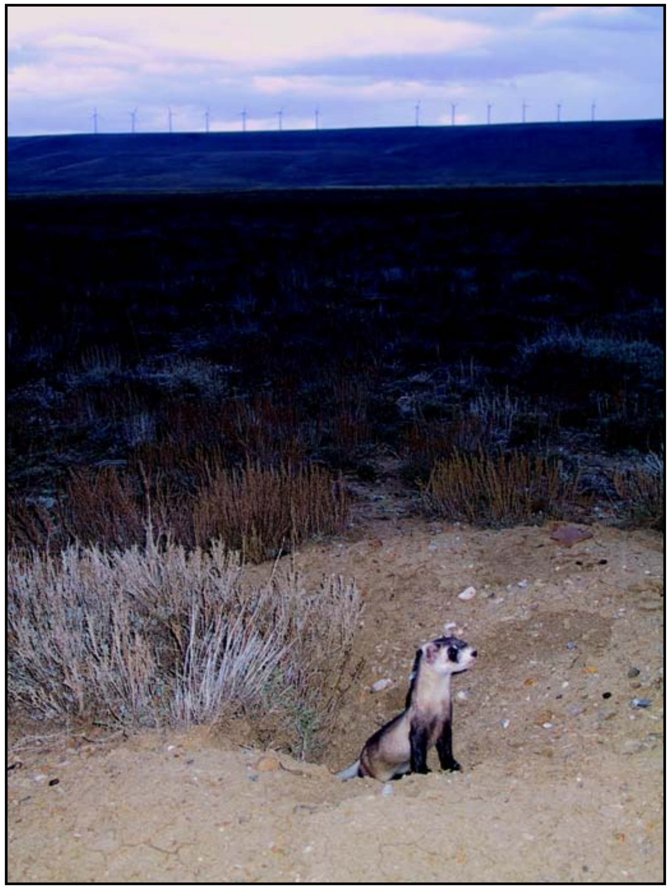
Executive Summary

Wyoming has world-class wildlife and wildland values that deserve protection, with some of the last intact and functioning ecosystems in the United States. At the same time, it has outstanding wind power resources that need to be developed so we can reduce our fossil fuel consumption. This generation has the opportunity to do wind energy development smart from the start, and the key to successful development will be siting wind power in areas capable of sustaining wind farms.

Wind power development offers a clean, renewable source of electricity that could help to replace fossil fuels, which contribute air pollution and exacerbate the problem of global climate change. As interest in constructing utility-scale wind power facilities increases, siting decisions that allow wind power development in such a way that protects special landscapes and sensitive wildlife is to the mutual benefit of wind power companies, government entities, local communities, and the larger public.

This report maps the location of sensitive wildlife habitats and landscapes sensitive to wind developments. Some of these categories of land are sufficiently sensitive to merit the exclusion of wind energy development, while other categories would permit wind energy development if certain best practices are implemented. By overlaying the various sensitive land types, a picture emerges showing where wind power development should be avoided (marked in red on the maps), where it could proceed with caution (mapped in yellow), and the areas lacking land use conflicts where it should be encouraged (marked in green).



Reintroduced black-footed ferret near the Foote Creek Rim wind power facility. BCA photo.

Considerations for Wildlife

Many types of wildlife are expected to be sensitive to wind power development. The propensity for wind turbines to kill birds (particularly raptors) and bats through collisions with spinning blades is well known, and thus turbines sited in areas where bird and bat activity is not concentrated are preferable. Turbine arrays can also lead to habitat fragmentation and displacement of wildlife from preferred habitats, especially for sage grouse and mountain plover. Potential impacts on big game in their crucial seasonal ranges and on burrowing small mammals remain poorly understood and more study is needed to reach definitive conclusions, but wind power facilities may be compatible with the habitat needs of these species if development is done carefully. Birds and small mammals will be sensitive to the placement of overhead power lines, and burying transmission lines through sensitive habitats could avoid significant impacts.

Sensitive Landscapes

Wyoming is known throughout the world for its iconic western landscapes. Many of these, like national parks, wilderness areas, and wilderness study areas, have been placed off-limits to industrial activities by federal law or regulation. Others, such as roadless areas and BLM Areas of Critical Environmental Concern, have limited protective designations which would tend to frustrate the timely development of wind projects and might preclude them in some cases. There is a third category of lands which may be unprotected at present but have a high public profile and strong scenic values, and wind power generation would face stiff opposition in these areas. Historical and cultural sites and historic trails are typically protected by federal law which requires that the sites as well as their historic settings be protected. Wind power developments near towns would profit from masking wind turbines for view or, if this is impossible, in gaining public buy-in to wind projects. Overall, open spaces in Wyoming are highly valued, which means that projects that do not impair prominent viewsheds are less likely to face opposition. By steering wind projects away from lands where industrial development would be prohibited or controversial, wind power generators can reap the benefits of speedier approval processes and strong public support.

Prioritizing Wind Power Development in Wyoming

When sensitive resources are overlaid with wind power potential on a map of Wyoming, it becomes apparent that some areas are unlikely prospects for wind energy (either due to a lack of wind power or multiple environmental sensitivities), while other areas have strong wind resources and few, if any, resource conflicts. These latter areas are the places where large-scale wind power generation should start, and in cases where transmission lines are limiting, these are the areas where transmission capacity should be built first. There are about 5 million acres of these "green" areas, more than 4 million acres of which have commercial wind power potential — more than enough space for commercial wind power development in the near future. Wind power development should start by developing in these "green zones" to the greatest extent possible, and transmission projects to support wind development should focus on providing service to these areas. Much of the area most favorable for wind energy development is private land, and the property rights of landowners will have to to be respected because unlike oil and gas development, wind power development always requires the consent of the landowner. By presenting areas of environmental sensitivity as well as the location of promising wind resource areas with few environmental conflicts, we foresee an ability for the wind industry, private landowners, and government officials to use incentives to steer wind development in Wyoming into areas that are noncontroversial and where impacts on lands and wildlife are minimal. Thus, the environmental benefits of switching away from fossil fuels can be maximized while Wyoming's outstanding landscapes and fully functioning ecosystems are protected.

Wind turbines near Medicine Bow
BCA photo

Summary of Key Siting Recommendations

Conduct demonstration studies to show no impacts before proceeding further	Big game crucial winter and parturition ranges, big game migration corridors.
Get local buy-in, site turbines out of sight when possible	Within 5 miles of municipalities.
Small wind facilities in low-value habitats	Ecoregional core areas, linkages, and portfolio sites; Bird Habitat Conservation Areas
Exclude from wind power siting consideration	National Parks, Monuments, and Wildlife Refuges; USFS Roadless Areas; citizens'proposed wilderness; BLM ACECs; raptor nesting concentration areas; nesting and wintering habitats of sage grouse, Columbian sharp-tailed grouse, and mountain plover.
Site wind power in areas hidden from view by topography	Within 5 miles of historic trails and sites, Continental Divide Trail, municipalities, and key overlooks in national parks, wilderness, and other high-value recreation areas.
Monitor bats/birds and avoid high-use areas; avoid forest fragmentation	Woodland and forest habitats.
Bury powerlines	Within half mile of prairie dog towns, grouse habitats, and black-footed ferret recovery areas.

Introduction

Across Wyoming, there is an unprecedented surge in wind energy development proposals. County, state, and federal agencies are inundated with proposals. The U.S. Department of Agriculture (n.d.) listed the Medicine Bow and Shoshone National Forests and Thunder Basin National Grassland among the National Forest system lands with the highest wind energy potential in the nation. Wind potential is even greater on private lands as well as public lands managed by the Bureau of Land Management in Wyoming's desert and grassland basins. While several wind power projects have been constructed during the past decade, there is currently a major "wind rush" in applications for rights of way and permits to set up utility-scale wind energy facilities in many parts of Wyoming.

The recent boom in oil and gas development was a painful experience in which Wyoming suffered the degradation of special landscapes, reduction or losses of wildlife populations, pollution problems, and disruption of community function. With the onset of large-scale wind energy development, Wyoming should develop wind energy in a way that protects open spaces and native ecosystems and is an asset to local communities rather than a disruption. Thoughtful siting of wind energy facilities and the adoption of Best Practices can ensure that wind energy is a net asset to the state and help the wind industry prevent unwanted conflicts with land and wildlife advocates or local communities. It is important for the wind industry to learn from the mistakes of the oil and gas industry, and not repeat them.

Pronghorn Photo courtesy BLM

This report provides a blueprint for doing wind smart from the start, by identifying areas where wind should be developed, where its shouldn't be attempted, and areas where wind development could be developed carefully with concessions to sensitive resources that allow wind power to be compatible with maintaining other values.

Smart from the Start is designed to be used by multiple audiences. The wind power industry can use this report to identify areas where wind power potential is greatest and the wildlife and social conflicts are smallest and earmark these areas to be developed first, while avoiding areas of high resource conflict. State, federal, and local regulators can use this report to guide how and where wind power facilities are permitted. And conservation groups and local citizens can use this report to prioritize the areas most important for protection while also recognizing areas where environmental conflicts are least significant.

It is our intent that this report will guide wind power planning on a statewide scale so that wind power generation can be expedited and fostered in areas of least conflict, while ill-advised forays into the state's most sensitive landscapes will be avoided. If wind power development is pursued in this manner, controversy and protracted conflicts can be avoided to the mutual benefit of the industry, our lands and wildlife, and the people of Wyoming.

Wind Power and the Solution to Global Climate Change

Wind power generation is seen as part of a solution to the problem of global climate change. Global climate change is driven by the production of carbon dioxide (CO_2) and other "greenhouse gases" according to the Intergovernmental Panel on Climate Change (IPCC 2007), and coal-fired electricity generation is a major part of the problem. Global climate change is a serious environmental crisis in its own right, causing rising sea levels, disappearance of certain habitats and displacement of others, changes in patterns of droughts and floods, and serious losses in biodiversity worldwide. To the extent that wind power displaces forms of electrical generation that emit greenhouse gases, it can be part of the solution to global climate change.

While the coal industry touts the potential of "clean coal," <u>all</u> coal-fired electrical generation in the U.S. at the present time is "dirty" from the perspective of carbon dioxide emissions, because there is presently no commercial coal-fired power plant in the United States that is sequestering its carbon dioxide to prevent emissions of CO_2 that trap heat in the atmosphere causing the "greenhouse effect." In 2005, electrical power generation produced 39% of all CO_2 emissions in the United States (National Research Council 2007). Demand for electricity continues to escalate in the United States, and the increase in wind power development may not keep pace with the overall increase in demand. As a result, the increase in wind energy may not result in an overall decrease in carbon dioxide and other pollutants due to a projected escalation demand for energy (National Research Council 2007).

Wind energy holds the promise to become a significant part of a clean energy portfolio in the United States. As a society, we have the choice of developing clean energy sources today and replacing dirty fossil fuel sources to reap the benefits of reduced greenhouse gas production, or we can put off developing clean energy solutions until we run out of fossil fuels and face the double crisis of accelerated climate change and ultimately an interruption in the energy supply that fuels our society. It is clear that it is in the best interests of Americans to replace fossil fuels with clean, sustainable energy sources; it is equally clear that Wyoming residents have a strong interest in ensuring that a major increase in industrial wind energy is done smart from the start, siting wind farms in areas that can sustain the presence of wind turbines.

The American Wind Energy Association (2000) projected that if all economically feasible land sites for wind energy development were installed with wind turbines, the resulting generation would supply approximately 20% of the nation's electricity needs. This new source could potentially displace a corresponding quantity of electricity from fossil fuels. Certainly, not all sites that are economically feasible are suitable for wind power development from an environmental or social perspective, so it is likely that wind energy will ultimately become a somewhat smaller percentage of overall electricity production in the United States. But wind energy does represent a potentially important part of a clean energy future in which it is complemented by a number of other renewable energy sources.

In the United States, coal-fired power plants currently supply the vast majority of “baseload power,” or the electricity that is being generated constantly regardless of consumption to meet basic power demands. Most of the “peak load” electricity generated to supply spikes in demand (such as heat waves that increase air conditioner use) is generated “on the margin” by natural gas-fired power plants that can easily be turned on and off in response to fluctuating demand. Both of these types of power generation are major emitters of greenhouse gases. Even though the wind in Wyoming is fairly consistent, the wind does not blow all the time, and skeptics have argued that the inconsistent nature of wind power generation precludes its use to replace coal as baseload power. Others (e.g., Deisendorf 2007), argue that conventional coal-fired baseload power stations are not completely reliable either, and when they experience a failure, they can be down for months. Archer and Jacobson (2007) found that by interconnecting a number of wind farms in different areas, differences in wind power output can be dampened and up to 47 percent of yearly averaged wind power could be relied upon to supply baseload electricity demand.

When considering the benefits of placing fossil fuels with wind energy in the context of global climate change, it is also instructive to consider the collateral effects of wind farm construction on natural carbon sinks. Hall (2006) found that the “carbon payback” period was longer for wind farms built in areas that function as carbon sinks such as forests and peat bogs because the wind facilities displaced carbon-sequestering natural systems. Thus, in Wyoming wind turbine arrays sited in grassland and desert areas would have a greater net carbon benefit, while those constructed in forests would have a somewhat reduced benefit in dampening the effects of global climate change.

Overall, it is apparent that the development of wind energy nationwide can be a part of the solution to the global climate change problem. But it is apparent that wind power will need to be supplemented with other types of clean, renewable energy in order to completely satisfy our nation’s energy appetite.

The Economic Advantages of Wind Power

Wyoming has been wracked by a series of energy booms and busts. These have stretched local communities and infrastructure to the breaking point during boom years while leaving economies on the rocks during the bust periods. Wind power generation, by contrast, creates steady income streams and highly skilled jobs that make it a sustainable asset to local communities in contrast to the massive influx of temporary workers and boom-and-bust income pattern of the oil and gas industry. For local economies, wind power creates more economic input per kilowatt than either coal- or gas-fired electricity generation (Tegen 2006). Wind power is a different type of energy industry that promises to employ well-paid professionals who will become long-term members of local communities and yield long-lasting and steady streams of income to local economies. Thus, wind power development is much more economically sustainable than oil and gas development.

A Blueprint for Doing Wind Smart from the Start

The key to doing wind smart from the start is pairing intelligent siting choices with sensible methods of development that minimize conflicts between utility-scale wind power projects and sensitive wildlife and landscapes. The potential for wind turbines to kill birds and bats is well-known, and this potential can be minimized by siting turbine facilities away from areas where birds and bats concentrate their flying activities, such as nesting sites, roosting areas, and migration flyways. Because wind power facilities are industrial developments, they have the potential to fragment habitats and displace sensitive wildlife to other areas. The wind industry and land and wildlife managers will need to develop an understanding of which species are most affected by wind projects and avoid the most sensitive areas. Finally, there is a social element to where, how fast, and how much wind energy development is appropriate. Wind energy development should avoid the most treasured landscapes and areas, get buy-in from local communities before constructing facilities next door, and modulate the pace and scale of wind development so that the open spaces and untamed character of the Wyoming landscape are not threatened and local residents are satisfied with the outcomes of development.

This report is based on Global Information System (GIS) mapping to show where sensitive resources and the best wind power potential are located. Each sensitive resource is mapped, and accompanying text outlines the nature of potential conflicts with wind energy development as well as Best Practices to minimize these efforts. Lands that should be avoided entirely are marked as red zones on the maps, while areas where wind energy could be developed if certain measures are taken to reduce impacts are marked in yellow. For these yellow zones, the requisite mitigation measures vary according to the nature of the conflict they are designed to resolve – in some cases, the “fix” will be relatively simple and easy to implement, while in other areas siting wind turbine facilities may be complex or difficult. At the end of the report, the red and yellow zones are overlaid against wind power potential, and “green zones” are identified where conflicts are minimal and wind energy development is encouraged.

This report is also designed to be a review of the scientific literature on wind power and its impacts, as a resource for industry, planners, and the public. We lean heavily in this report on studies that have been conducted across the nation on impacts of wind energy and the properties of sensitive wildlife in formulating our recommendations. Large-scale wind energy development is a relatively new phenomenon, and we rely on peer-reviewed science whenever it is available and supplemented it with unpublished studies and monitoring reports that are more widely available. Tested scientific hypotheses are used preferentially to the opinions and recommendations of experts in all cases.

Special Landscapes

There are certain special landscapes which, due to their iconic qualities, pristine nature, or recreational values are not compatible with industrial use. Many of these lands have received official designations of one sort or another, while others have not yet been recognized by agencies as special places. Historic and cultural areas are covered in a later section, but this section will address landscapes that enjoy special designations that preclude wind energy development by law or regulation, or where wind energy development is likely to be frustrated because these areas have been designated for other land use priorities.

National Parks and Monuments

Units of the National Park system (including National Parks and National Monuments) are managed under a strong legal mandate which directs the federal government to "protect and preserve" these lands and their natural resources "for the use and enjoyment of the public." National Park units are precluded from industrial development (although commercial development for tourism is permitted. Wind energy development would not be allowed by law in these units regardless of their wind energy potential, and key viewsheds visible from park overlooks should be protected from visible wind energy development as well.

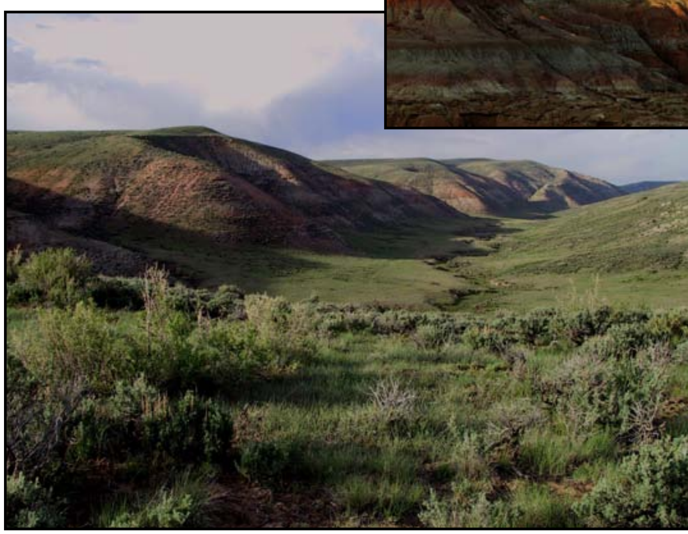
Designated Wilderness

Certain lands in Wyoming have been designated by Congress as Wilderness under the Wilderness Act. Although lands managed by all federal agencies are eligible for wilderness designation, in Wyoming only National Forest lands have been granted wilderness designation so far. By law, wilderness areas are a place "where the Earth and its community of life are untrammeled by man;" which generally appears to be affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; and "where man himself is a visitor who does not remain." In addition to the backcountry recreation values present in wilderness, these areas can also possess superior habitat features in the absence of significant human disturbance. For example, Kershner et al. (1997) found that adult density, size, and habitat quality were greater for Colorado River cutthroat trout in wilderness areas compared to adjacent roaded forest lands.

Developments such as roads and wind turbines are not permitted by law in wilderness areas, and thus these areas are not worth considering for wind power development regardless of their potential. Viewsheds visible from key overlooks within wilderness areas also should be kept free of wind turbines by hiding turbine arrays behind intervening topography.

Wilderness Study Areas and Citizens' Proposed Wilderness

In 1976, the Bureau of Land Management was directed by Congress to inventory its lands for wilderness qualities and establish Wilderness Study Areas ("WSAs") for congressional consideration under the Federal Land Policy and Management Act. Some 63 of these units have been established in Wyoming, managed under the BLM's Interim Management Policy. For all proposed projects and activities in Wilderness Study Areas, BLM has the responsibility to "Review the proposal to determine whether, in a specific case, the activities will be nonimpairing and to ensure that the approval of such activities will not create a situation in which the cumulative effect of existing activities and the new proposed activities would impair wilderness suitability." BLM Handbook H-8550-1, p. 13. All Wilderness Study Areas in Wyoming are also classified as Visual Resource Management Class I, in which the goal is "to preserve the existing character of the land-

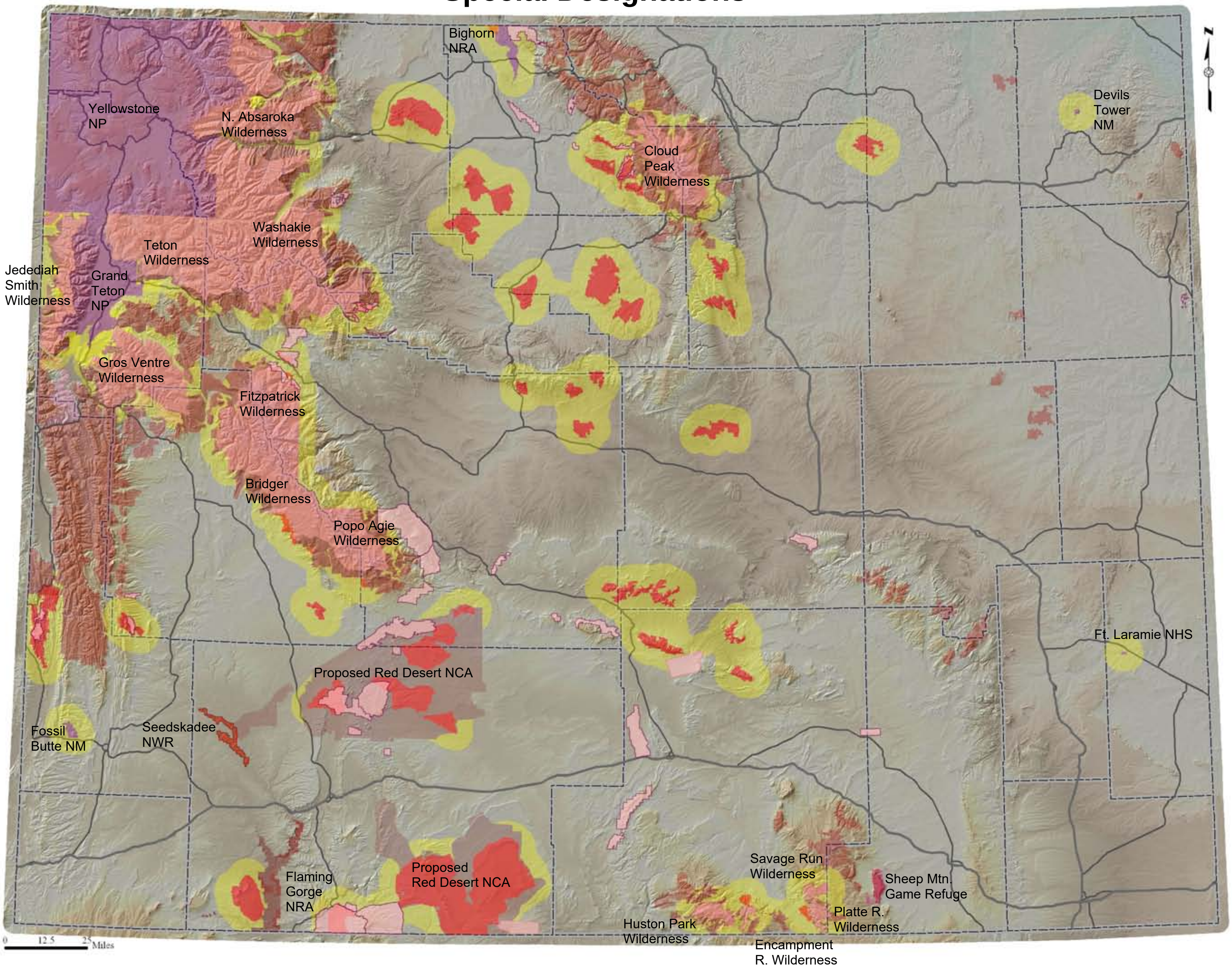


***Above:** Honeycomb Buttes WSA , Ken Driese photo*
***Left:** Wild Cow Creek citizens' proposed wilderness, BCA photo*

Map Legend

Nat'l Paks and Monuments	BLM ACECs	Proposed ACECs
Nat'l Recreation Area	Nat'l Wildlife Refuge	USFS Roadless Areas
	Nat'l Game Refuge	Citizens' Proposed Wilderness
	Designated Wilderness	Proposed National Conservation Area

Special Designations



scape." BLM Handbook H-8410-1. These lands are therefore unavailable for wind energy development under BLM regulations.

Citizens' proposed wilderness areas in Wyoming have been field inventoried and found to possess wilderness characteristics that would make them suitable for formal designation under the Wilderness Act. These areas, typically on Bureau of Land Management Lands, may have been excluded from the initial round of Wilderness Study Area designations in the late 1970s due to faulty initial inventories, failures by BLM to examine the areas in question as potential wilderness, or changes in conditions on the ground in which human intrusions which formerly would have excluded an area from wilderness consideration have disappeared. Citizens' proposed wilderness areas represent Wyoming's most pristine and outstanding examples of unprotected public lands, and as such are treated as exclusion areas for wind power development for the purposes of this report.

Forest Service Roadless Areas

The Forest Service has undertaken three rounds of intensive national inventories to determine which of its lands remain roadless and wild. These culminated in the Roadless Area Conservation Rule, established in 2000, which set these areas aside and prevented road-building, oil and gas leasing, and most other industrial uses.

The Roadless Rule has been embroiled in litigation since its inception. The Bush administration canceled the protections of the Roadless Rule in 2003, but litigation followed and the courts reinstated it in 2006. In 2008, a different court blocked the protections of the Roadless Rule, and this ruling is currently being challenged in a higher appeals court. Throughout the legal wrangling surrounding the Roadless Rule, the Forest Service has been very cautious and has proposed very few projects that do not comply, even during periods where it has been blocked from taking effect.

Above: *Southern Wyoming Range Roadless Area. Erik Molvar photo.*

At Right: *Duck Creek Roadless Area, Thunder Basin National Grassland.*

A number of species require large expanses of habitat free from the intrusions of resource extraction and high-intensity recreation, and these species have benefited from Roadless Area protection. This is particularly true for top carnivores. Many top predators, such as the wolf, grizzly bear, lynx, and wolverine, already have been driven extinct by past human incursions. Van Dyke et al. (1986) stated that "areas where there is continuing, concentrated human presence or residence are essentially lost to the [mountain] lion population, even if there is little impact on the habitat itself."

Other large predators as well as game animals such as elk are threatened by the disappearance of large, roadless tracts of habitat that serve as security areas. Edge and Marcum (1991) found that elk use was reduced within 1.5 km of roads, except where there was topographic cover. Gratson and Whitman (2000) found that hunter success was higher in roadless areas than in heavily roaded areas, and that closing roads increased hunter success rates. Cole et al. (1997) found that reducing open road densities led to smaller elk home ranges, fewer movements, and higher survival rates. Thus, roadless areas have come to provide important security habitat for elk.

In addition, many wildlife species are interior forest obligates that require large tracts of mature forest typically found only in roadless areas as a result of forest fragmentation due to half a century of clearcutting in other parts of our national forests. Examples include the northern goshawk (Reynolds et al. 1982, Squires and Ruggiero 1996, Graham et al. 1999), red-breasted nuthatch (Keller and Anderson 1992, Carter and Gillihan 2000, Ruefenacht and Knight 2000, Hansen and Rotella 2000), brown creeper (Keller and Anderson 1992, Crompton 1994, Hansen and Rotella 2000, Carter and Gillihan 2000), yellow-rumped warbler (Keller and Anderson 1992, Crompton 1994, Carter and Gillihan 2000), mountain chickadee (Keller and Anderson 1992, Carter and Gillihan 2000), hermit thrush (Keller and Anderson 1992, Evans and Finch 1993, Carter and Gillihan 2000), ruby-crowned kinglet (Carter and Gillihan 2000, Ruefenacht and Knight 2000), American marten (Buskirk 1992, Romme et al. 1992), red-backed vole (Romme et al. 1992), red squirrel (Romme et al 1992), and wood frog (deMaynardier and Hunter 1998). These species are vulnerable to forest fragmentation, and roadless forests are the core habitat that maintains reservoirs of these declining species.

Roadless areas contain some of the most outstanding trout habitat that remains (USFS et al. 1993, Henjum et al. 1994, Wissmar et al. 1994, Rhodes et al. 1994, Huntington 1998, Rhodes and Huntington 2000). Plans for the protection and restoration of declining salmonids have repeatedly called for the complete protection of all roadless areas larger than 1,000 acres (Henjum et al. 1994, Rhodes et al. 1994, Espinosa et al. 1997). Huntington (1998) noted that native cutthroat trout were larger and more numerous in the unroaded areas.

As a result of the elevated habitat values found in roadless areas and their importance to backcountry recreation, roadless areas have consistently been among the most contentious areas to site an industrial development project. Wyoming conservation groups have fought harder to protect roadless lands from intrusion than for any other land category that is managed by the Forest Service, and these groups have succeeded in blocking a number of projects, from timber sales to oil and gas seismic projects and drilling, proposed for roadless lands. It is likely that these lands will ultimately receive regulatory protection that would preclude wind area development. But even if this turns out not to be the case, wind energy developers would be wise to treat roadless areas as “no go” zones to avoid conflicts easily resolved by siting projects elsewhere.

Areas of Critical Environmental Concern

Federal law directs the Bureau of Land Management to establish Areas of Critical Environmental Concern (“ACECs”) and to protect the sensitive resources for which these lands were designated. Over the years, a number of ACECs have been established under the land use planning process, and still others have been proposed for plans currently being revised. The designation of ACECs does not confer a uniform set of protection measures; instead each ACEC has its own mandatory set of rules and regulations. While most ACECs do not address wind energy development directly (indeed, most were designated before wind power was recognized as a possibility in Wyoming), wind energy development in these areas is likely to pose difficult challenges and require longer and more expensive permitting processes. In addition, two key proposed ACECs, covering the Ferris Dunes and Powder Rim, have also been included due to their environmental sensitivity. Because it will be difficult to show that utility-scale wind power development will be consistent with the protection of resources for which the ACECs were designated, we recommend that ACECs be viewed as avoidance areas by the wind industry. The single exception is an ACEC designated in the Salt Creek oilfield which was established to recognize the toxic waste dumps in this heavily impacted area.

Proposed National Conservation Area and Other Congressional Designations

Wyoming has three crown jewel landscapes of national importance which currently do not receive sufficiently strong protection but which are top priorities for conservation: Adobe Town and the Jack Morrow Hills area in the Red Desert, and the Wyoming Range. These areas have been proposed for conservation action by Act of Congress.

Conservation groups have proposed a Red Desert National Conservation Area that would encompass some of the area’s most spectacular landscapes and most important wildlife habitats. It has two separate units, a northern unit encompassing the Jack Morrow Hills planning area and a southern unit encompassing Adobe Town and the Kinney Rim. Pristine wilderness and prime hunting and recreation areas are among the key features of these units. During planning processes, the prospect of industrial development in these special places raised a wave of public furor and controversy throughout the state: Over 64,000 people demanded that oil and gas drilling be excluded from the Jack Morrow Hills, and over 88,000 people commented in favor of protecting Adobe Town during the Great Divide plan revision. Both totals set new records for public participation in any federal plan or project. Due to the highly controversial nature of industrial use in these areas, they should be treated as avoidance areas for the purposes of wind energy development.

The Wyoming Range has also been a flashpoint for controversy over oil and gas drilling, and a bill is currently under consideration that would withdraw 1.2 million acres of the Bridger-Teton National Forest from consideration for future leasing (although oil and gas development may occur on existing leases, and perhaps a limited area for future leasing). Wind projects in this area could face stiff opposition depending on which part of the area is under consideration; we recommend avoiding wind development in the Wyoming Range proper and proceeding only with great caution with strong public support in the rest of this area.

Best Practices for Special Landscapes

Special landscapes in these categories should be exempted from consideration for wind power development in order to preserve the attributes for which these lands have received special designations. For national parks, wilderness areas, and BLM citizen’s proposed wilderness, we also recommend a 5-mile viewshed buffer within which wind power projects could proceed if they are not visible from prominent overlooks.

Above: *Oregon Buttes in the Northern Unit, Proposed Red Desert NCA. Pat Sullivan photo.*
Below: *Adobe Town in the Southern Unit, Proposed Red Desert NCA. BCA photo.*

Ecoregional Conservation Plans

Most conservation plans focus on a single species or a small subset of species, typically those which are unusually charismatic or a species that is the subject of hunting or fishing. The designation of lands in protected areas such as national parks and wilderness also contains biases, over-representing certain habitat types (such as alpine meadows) while other habitat types (like playas and sand dunes) tend to be underrepresented (Merrill et al. 1996). When considering the conservation of entire ecosystems and the wide array of plants and wildlife they support, however, it is preferable to take an ecoregional approach, because the distribution of plants and wildlife rarely respects arbitrary political designations like state lines and field office boundaries. In Wyoming, several ecoregional plans provide a framework for conservation of ecosystems on a large scale, and core habitats and connecting corridors identified in these plans warrant extra caution when planning and siting wind power facilities.

The Heart of the West Conservation Plan

The Heart of the West Conservation Plan was developed for the Wyoming Basins Ecoregion, which covers the western two-thirds of Wyoming as well as parts of Colorado, Montana, Idaho, and Utah (Jones et al. 2004). This plan is based on the identification of core areas and connecting corridors; cores were identified using SITES modeling and focusing on the habitat needs of 20 focal species as well as maximizing representation of a broad diversity of habitat types and capturing rare species occurrences. The result is an interconnected network of core areas and linkages prioritized for conservation protection and/or restoration, in a matrix of Sustainable Use Areas where industrial use is appropriate where pursued on a scale and in a fashion that is not destructive to other values.

An irreplaceability and vulnerability analysis was then performed on these core areas to determine which core areas should be of greatest conservation concern (Jones et al. 2006). Five of the eight core areas that scored highest in these two categories are located in Wyoming: the Upper Red Desert, Medicine Bow, Upper Green River, Absaroka Front, and Adobe/Vermillion core areas. These core areas merit the highest degree of conservation attention and protection.

The Northern Plains Conservation Network

In contrast to the Heart of the West Conservation Plan, the Northern Plains Conservation Network (NPCN) was formed as a coalition of conservation groups that formed to conduct a scientific inventory of this region's wildlife and habitats with the goal of identifying areas with excellent opportunities for large-scale wildlife restoration. This conservation inventory focused on portfolio sites rather than a core-and-linkage approach that conserves habitat and connectivity on a regional scale (Forrest et al. 2004). While conservation across the entire region is important, NPCN found that these sites offer the greatest promise for the re-creation of a fully functioning grassland ecosystem.

Two of the portfolio sites identified by NPCN cover significant extents of land in Wyoming, while a small portion of the Slim Buttes area overlaps the northeast part of the state (*see* Forrest et al. 2004). The Hole in the Wall unit was selected due to significant mountain plover habitat, significant acreage of prairie dog colonies, relatively intact grasslands, and large contiguous land area under BLM management. The Thunder Basin – Oglala Grasslands area was selected for its abundance of pronghorn and prairie dog colonies and high potential for the reintroduction of the Endangered black-footed ferret. To date, black-footted ferrets have been reintroduced to the Conata Basin in the Oglala National Grassland and to Badlands National Park, both in South Dakota, and a reintroduction effort is planned for the Thunder Basin National Grassland in Wyoming.

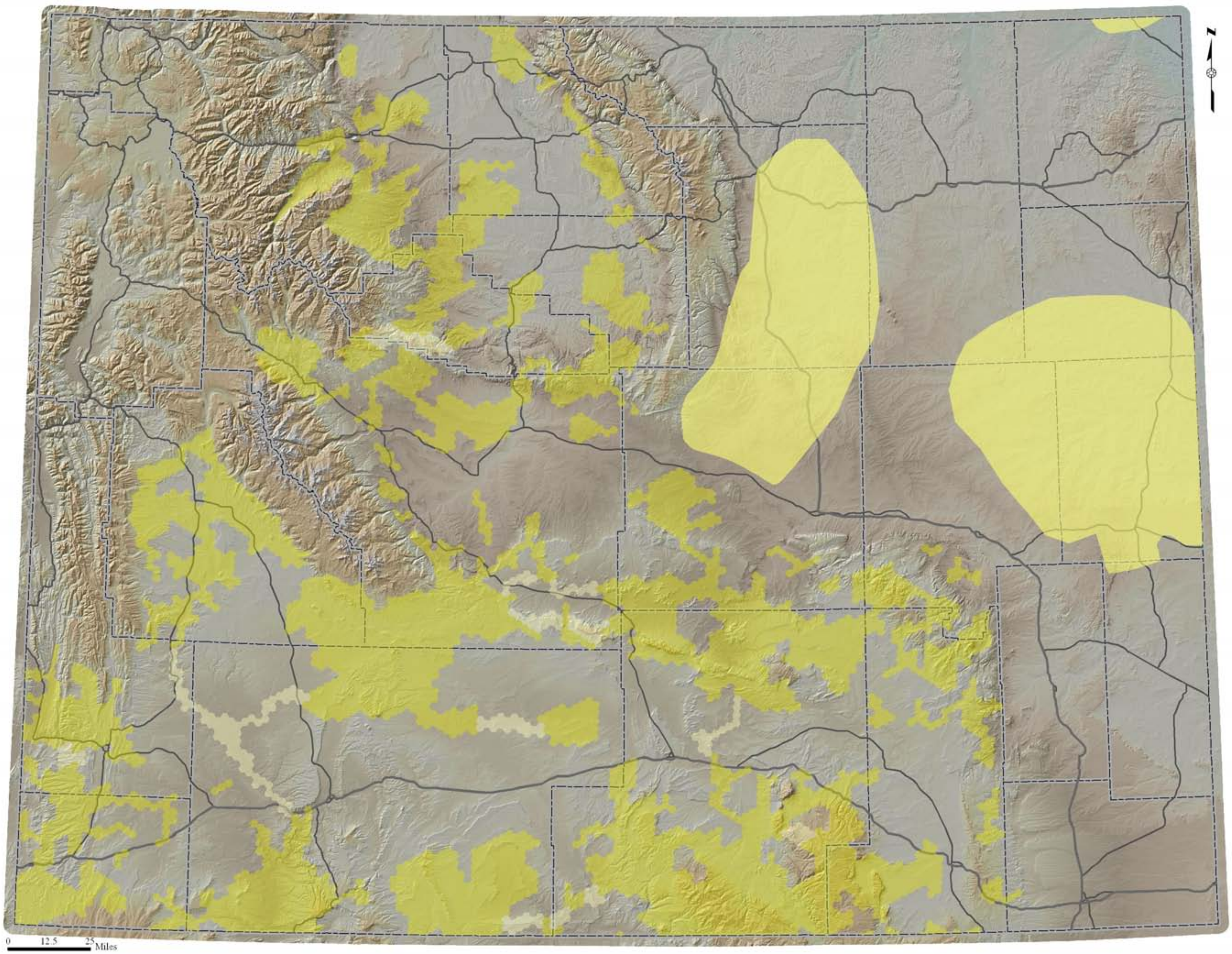
Best Practices for Identified Core and Linkage Areas

We recommend that great caution be exercised when siting wind projects in core areas and linkages and should be limited to small-scale projects in low-habitat-value areas. In the Wyoming Basins ecoregion, utility scale wind projects would be better suited to Sustainable Use Areas identified in the Heart of the West plan.

Map Legend

- Heart of the West Core Areas
- Northern Plains Conservation Network Core Areas
- Heart of the West Linkages

Ecoregional Conservation Plans



Protecting Birds of Prey

One of the first large-scale wind energy facilities was sited at Altamont Pass in the foothills east of San Francisco Bay. Altamont Pass is a raptor nesting concentration area that also served as a flyway for winter migrations (Thelander and Rugge 2000). As a result of the high concentration of birds in this area, the level of fatalities for golden eagles and other birds struck by turbine blades rose so high that the facility became famous as "the bird blender." Most of the wind power facilities that followed had much lower rates of bird fatalities, but the reputation of wind turbines as killers of birds has been a difficult one for the industry to escape from. The lesson to be learned is siting the facility in an area of high bird concentrations, particularly for golden eagles and other raptors, created a major ecological problem that has made it more difficult for other projects to get started nationwide. This report seeks to identify key raptor habitats so that this problematic chain of events can be avoided in Wyoming.

Ferruginous hawk, a BLM Sensitive Species. Mark Chappell photo.

Birds of prey are simultaneously among the most visible and charismatic birds (and thus are a public favorite), and are more vulnerable to wind turbine fatalities than other types of birds. At Tehachapi Pass in California, Anderson et al. (2004) found that red-tailed hawks, American kestrels, and great horned owls showed the greatest risk of collision of all bird species. At Altamont Pass, Thelander and Rugge (2000) reported that golden eagles, red-tailed hawks, and American kestrels were killed with greatest frequency. In Minnesota, Osborn et al (2008) reported that the American kestrel was at highest risk of wind turbine mortality, spending 31% of flying time at heights within the blade-swept area of wind turbines. Smallwood and Thelander (2005) found that burrowing owls were also highly susceptible to turbine-related mortality, and estimated 181 to 457 burrowing owls were killed per year at the Altamont Pass facility.

Smallwood and Thelander (2005) were able to determine that bird species that spent the most time flying through turbine-swept areas had the highest mortality rates. At the Foote Creek Rim facility, birds that spent the greatest proportion of time flying through rotor-swept heights included raptors and waterfowl (Johnson et al. 2000). These bird groups were found to have the highest risk of turbine collision in California (Osborn et al. 2008).

Wind turbine mortalities can potentially result in population declines in raptors most heavily impacted by turbine strikes. Hunt et al. (1998) found that the golden eagle population was declining, and wind turbine strikes accounted for 38% of mortalities. Even if projects kill primarily non-territorial "floater" birds rather that territorial breeders, population declines can result because stable populations of breeders rely on an abundant supply of floaters to replace birds lost to other sources of mortality (Hunt 1998).

It does not appear that raptors make behavioral adjustments to wind power facilities that reduce fatality rates over time. Indeed, Smallwood and Thelander (2005) found that per-capita risk of raptor fatalities for individual birds actually increased over the 15 years of study, even as raptor densities decreased.

The position of turbines within a tower array does not appear to have a consistent correlation with raptor mortality. For example, Anderson et al. (2004) reported that turbines at center of strings experienced higher raptor fatality rates. Meanwhile, the Predatory Bird Research Group (1995) found that end-row turbines produced greater fatality totals at Altamont Pass. Thelander and Rugge (2000) found no relationship between fatality rates and edge or center of array at the same Altamont Pass location.

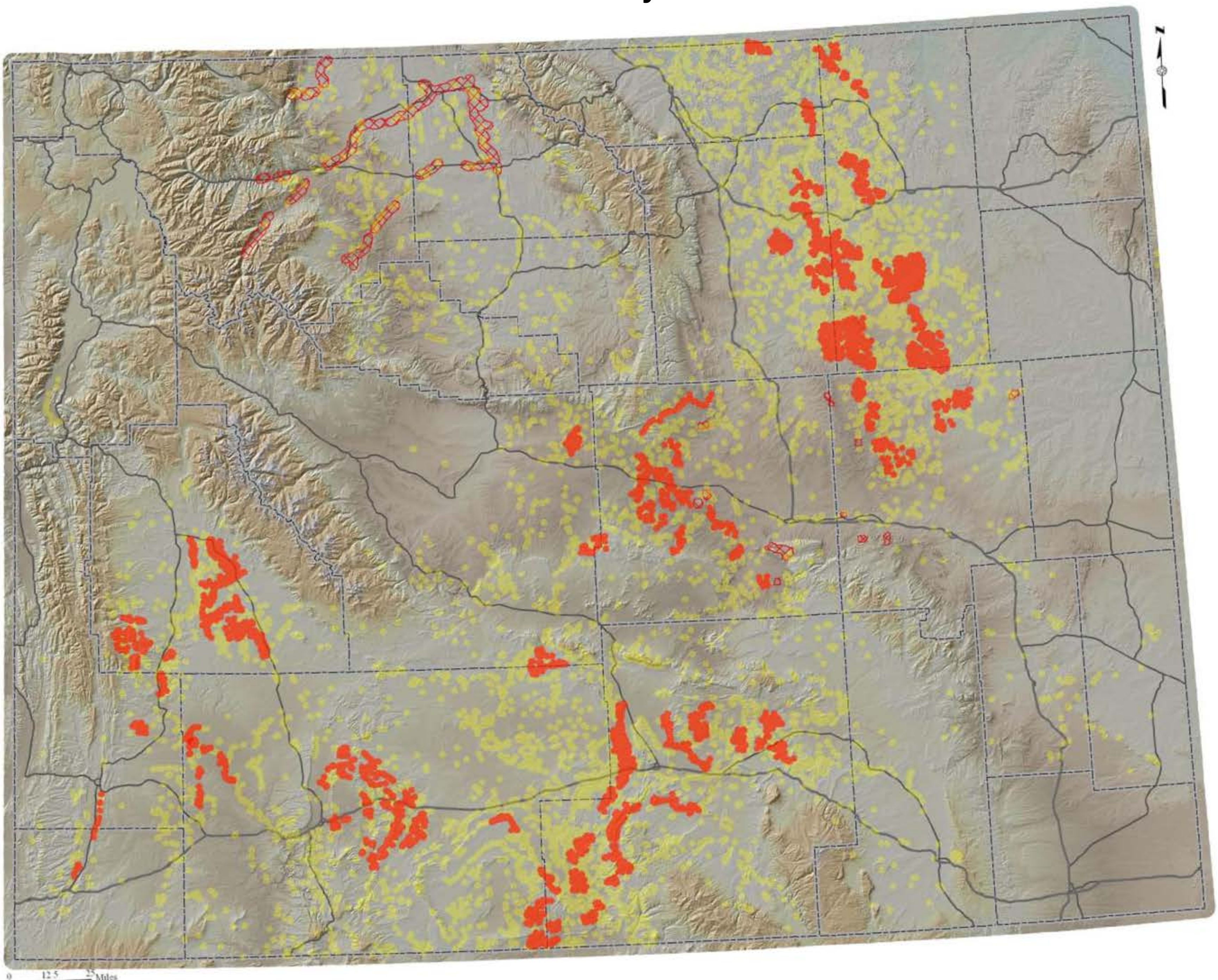
The type of wind turbine also does not have a clear relationship to rates of raptor mortality. According to the Predatory Bird Research Group (1995), both red-tailed hawks and golden eagles were recorded perching on lattice-type wind generation towers at Altamont Pass. Both species avoided perching on tubular towers but red-tailed hawks were occasionally recorded perching on the catwalks and ladders of such towers in this study. Thelander and Rugge (2000) later found no difference between raptor fatality rates at lattice towers versus tubular towers at Altamont Pass, and Smallwood and Thelander (2005) even found that raptor fatalities at Altamont Pass were greater for tubular towers and larger-rotor turbines. Anderson et al. (2004) found that vertical axis turbines of the FloWind type used at Tehachapi Pass had similar bird fatality rates to horizontal-axis (propeller-style) turbines. Thus, it appears that more modern wind turbines offer no particular advantage in reducing raptor mortality.

It is unclear whether a high density of wind turbines increases or decreases raptor mortalities. Dense clusters of turbines and "wind wall" configurations (parallel rows of wind turbines closely aligned to each other but with alternating tower heights) killed fewer raptors than scattered turbines (Smallwood and The-

Map Legend

- Raptor Nesting Concentration Areas, one-mile nest buffer
- Other identified raptor nest sites, one-mile nest buffer
- Identified bald eagle roost areas, one-mile buffer

Birds of Prey



lander 2005). However, fatality results at Tehachapi Pass suggest that high density sites cause greater fatality rates than low density (1 turbine per 100 meters) density of turbines, but this difference was not statistically significant (Anderson et al. 2004). More study is needed to determine whether advantages can be gained by altering the density of turbine arrays.

The National Research Council (2007) reported that raptor mortality rates in California per megawatt of installed capacity have been much higher than at other wind facilities across the nation. But Smallwood and Thelander (2005) pointed out that rates of bird fatalities per unit bird/time at Altamont Pass were similar to other turbine facilities, but the much greater bird densities at Altamont Pass drives the high level of fatalities there. According to these researchers,

> "To assert that the APWRA [Altamont Pass Wind Resource Area] is anomalous in its bird mortality may be misleading when comparing it to other wind energy facilities. While a relatively large number of raptors are killed per annum in the APWRA, the ratio of the number killed to the number seen during behavior observations is similar among wind farms where both rates of observation have been reported. It appears, based on the research reports reviewed for this project, that when comparing wind energy facilities birds tend to be killed at rates that are proportional to their relative abundance among wind farms."

This points out the critical importance of avoiding raptor concentration areas when siting wind energy facilities. In areas where there are concentrated raptor nest sites, there will be elevated raptor activity as at Altamont Pass, with higher raptor mortality rates. This is of particular concern in cases where raptor nests may be upwind of nest sites, and strong prevailing wind would have the tendency to carry fledgling raptors with underdeveloped flight skills straight into turbine swept areas.

The Altamont Pass wind facility was built in a golden eagle nest concentration area, and became highliy controversial as a result of raptor fatalities. Dan Chusid photo.

Raptors can function as keystone species (National Research Council 2007), potentially controlling populations of prey species and inducing trophic cascades. Thus, impacts to these classes of species could result in collateral impacts at the ecosystem level. A certain level of avian mortality is virtually unavoidable with wind power projects, but intelligent siting of turbine arrays should minimize the level of mortality from the project. Such impacts should be minimized by taking the following steps in the siting and operation of wind power facilities.

For the purposes of this report, GIS data for known nest locations was used to develop raptor nest concentration areas, which should be avoided, to be distinguished from scattered raptor nest locations, which are marked in yellow for caution. It is important to note that some areas (like the Powder River Basin) have experienced heavy raptor nest monitoring activity, while other areas have had lighter search effort. Also notable is the fact that the Newcastle BLM Field Office was unable to provide GIS data of any kind for this report, which explains the absence of raptor nest locations in the far northeastern corner of Wyoming.

Best Practices for Birds of Prey

Avoid Siting Turbines Near Raptor Concentration Areas

The Buffalo Ridge wind project showed low bird mortality rates (0.33 to 0.66 fatalities per turbine per year), likely due to its siting in a lower bird density area (Osborn et al. 2000). These researchers admonished that even a well-sited facility will kill some birds, but siting considerations can be employed to minimize raptor mortalities. At Wyoming's Foote Creek Rim wind facility, only eight percent of bird mortalities between 1998 and 2002 were raptors (Young et al. 2003). This has been attributed to several factors, including low density of raptor nest sites. By avoiding raptor nest concentration areas and migration flyways, raptor fatalities can be minimized.

Avoid Siting Wind Farms in Canyons, Passes, and Other Migration Pathways

Siting turbines in canyons and passes increases the risk of fatalities for migrating birds. In Montana, Harmata et al. (2000) found that more migrating birds passed over valleys and swales than over high points; while migrating birds tended to avoid passing over high points during headwinds, low passes received greatest use by migrating birds overall. Smallwood and Thelander (2005) found that golden eagles at the Altamont Pass facility were killed disproportionately by turbines sited in canyons. Thayer (2007) recommended, "Don't site wind turbines in canyons" to prevent excessive golden eagle fatalities. We concur with this recommendation, and it should be implemented as a best management practice for wind projects.

Engage in Pre-siting Surveys and Monitoring

Pre-siting surveys of bird habitat use and migration pathways should be undertaken prior to the determination of tower locations and arrays. In addition, pre-siting surveys of raptor and mountain plover nesting areas should be undertaken and these areas should be avoided for wind turbine siting. According to Morrisson (2006), "Such pre-siting surveys are needed to appropriately locate wind farms and minimize the impacts to birds." According to Mabee and Cooper (2004:45), "Seasonal patterns of noc turnal migration are critical to identify when collisions with wind turbines may be most expected." Analysis of bird migration data allowed the company to position its turbines to minimize mortality in the Stateline project of southeastern Washington (id.). Migration patterns should be analyzed prior to the initiation of project construction, and turbines should be sited to avoid them.

Require Setbacks from Windward Rims

At Altamont Pass, Hoover and Morrisson (2005) reported that kiting behavior was most frequently observed on steep windward slopes, and selected for the tallest peaked slopes; slopes where this behavior occurred had a disproportionate amount of red-tailed hawk mortality. In the context of the Foote Creek Rim project, Johnson et al. (2000) also reported higher than expected raptor use of rim edge habitats, and for this project SeaWest implemented a setback of at least 50 meters from the rim for wind turbines to reduce raptor mortality; 100 m setbacks would be better.

Fledglings like these young ferruginous hawks may be particularly vulnerable to rotor collisions. Mike McClure photo.

Vertical-axis wind-turbines of the FloWind type have been found to have similar rates of raptor deaths as conventional propeller-style turbines (Anderson et al. 2004). Symscape photo.

Bald eagle in flight. USFWS photo.

Minimizing Impacts to Bats

Initially, bird mortality was perceived as the most important impact of wind energy projects, but more recently it has come to light that wind turbine facilities can be a major source of bat fatalities as well. Kunz et al. (2007b) reported that bat fatalities at wind power facilities ranged from 0.8 to 53.3 bats per megawatt per year, with the highest mortality rates in forested areas. Taller towers with greater rotor-swept area showed greater bat mortality rates than smaller wind turbines in the same region (Arnett et al. 2008). As the trend within the industry is toward taller wind turbines with larger propellers, it is expected that risk to bats will increase further over time.

Bats may be more vulnerable to mortality at wind power facilities than birds because bats seem to be attracted to operating turbines. Arnett (2005) hypothesized that hoary bats may confuse turbine movements for flying insects and be drawn toward operating turbine blades. Johnson et al. (2004) also hypothesized that turbines attracted foraging bats in the agricultural lands of southwestern Minnesota. The attraction of bats to wind turbines during feeding was validated experimentally by Horn et al. (2008), with foraging bats approaching and pursuing moving turbine blades and then being trapped by their vortices of air. Bats sustain potentially fatal injuries not only from turbine strikes but also from potentially deadly decompression associated with air pressure gradients cased by spinning turbines (Arnett et al. 2008).

Bats have long lifespans and low reproduction rates and thus are more susceptible to population declines (GAO 2005, National Research Council 2007). According to the North American Symposium in Bat Research (2008), "Because bats have exceptionally low reproductive rates, making them susceptible to population declines and local extinctions, bat fatalities at wind facilities could pose biologically significant cumulative impacts for some species of bats unless solutions are found." In cases where bat populations are suffering from other population or habitat stressors, wind turbine siting in key bat habitats can have decisive impacts on the population. Bats can function as keystone species (National Research Council 2007), potentially controlling populations of insects and inducing trophic cascades. Thus, projects that cause major impacts to bat populations could also destabilize ecosystem function.

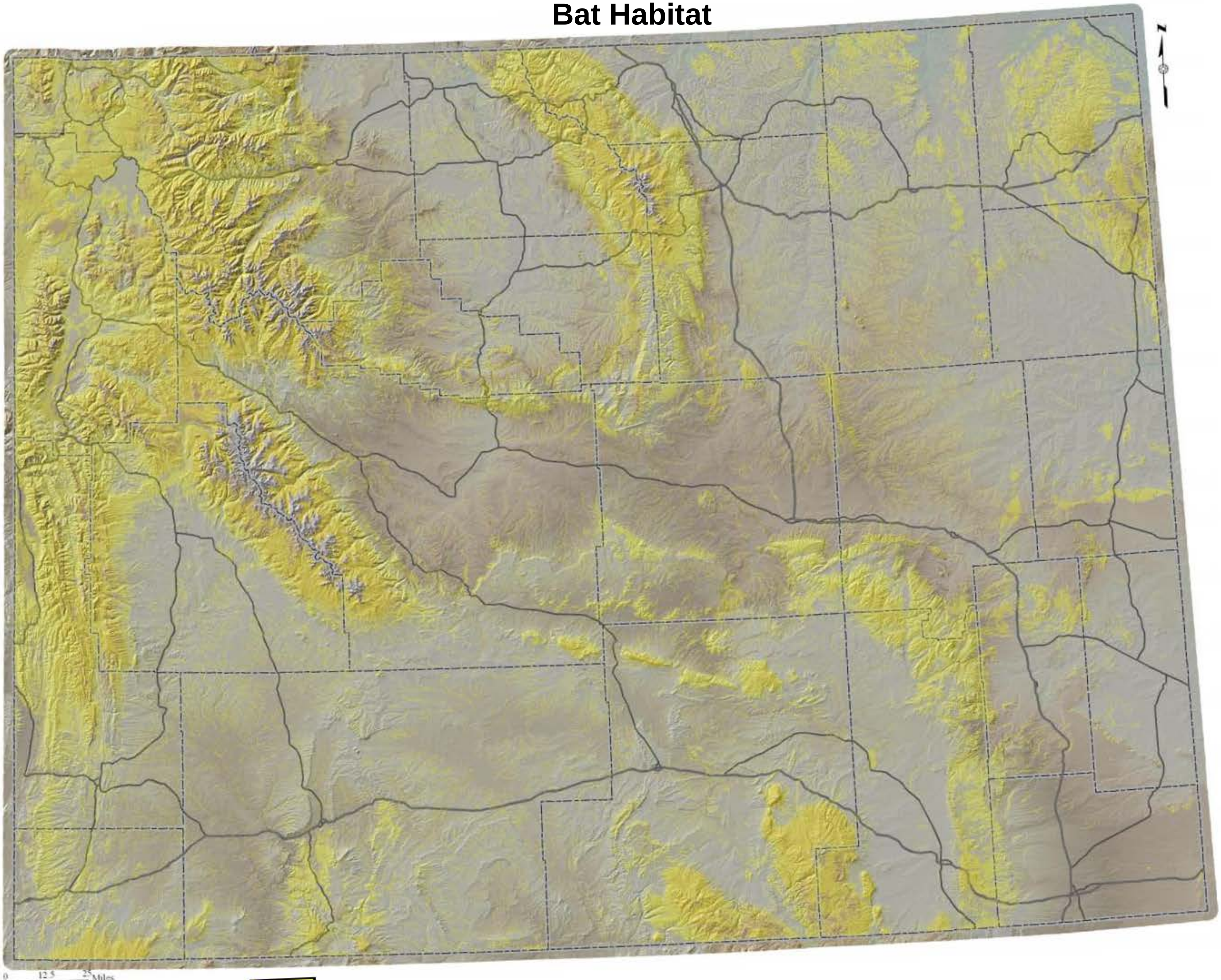
Hoary bats in Flight. Photo by J. Scott Altenbach

Almost 75% of all bats killed by wind turbines nationwide are made up of three species of tree-roosting, migratory Lasiurids: the foliage-roosting eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and tree cavity-dwelling silver-haired bat (*Lasionycteris noctivagans*) (Kunz et al. 2007a, Arnett et al. 2008). Hoary and silver-haired bats dominated bat mortalities at wind facilities sited in open steppe habitats of the interior Columbia Basin (Johnson et al. 2003, Erickson et al. 2003). Johnson et al. (2004) found that hoary bats dominated wind turbine fatalities at the Buffalo Ridge wind facility in agricultural lands of southwest Minnesota, even though big brown bats were the most numerous resident population. In the Rocky Mountains, 89% of wind turbine bat mortalities are hoary bats (Kunz et al. 2007a). Of the tree-roosting bat species, the hoary bat and silver-haired bat are native to Wyoming and are found throughout the state.

Key habitats for tree-roosting bats and other bat species are poorly understood, and maps are not currently available designating critical habitats. According to the U.S. Forest Service (no date), "Hoary bats rely on deciduous woodlands (e.g., aspen stands and cottonwood stands) for roosting sites in the Rocky Mountains, and seem to rely somewhat on cottonwood riparian corridors in the non-forested and coniferous areas of their range." According to the Wyoming Game and Fish Department, the hoary bat is associated not only with cottonwood gallery forests but also coniferous forests and juniper woodlands. Everette et al. (2001) documented hoary bat use of cottonwood groves for roosting on the Rocky Mountain Arsenal near Denver. According to the Wyoming Game and Fish Department's Comprehensive Wildlife Conservation Strategy, the silver-haired bat is uncommon in Wyoming and prefers the following habitats:

> "The silver-haired bat inhabits coniferous and mixed deciduous-coniferous forests and woodlands, including juniper, subalpine fir, Engelmann spruce, limber pine, Douglas-fir, aspen, cottonwood, and willow. It is most commonly associated with forested and montane habitats adjacent to lakes, ponds, and streams; occurs most frequently in stands of late-successional forest; and may be reliant on older forests for roost trees. It roosts almost exclusively in trees, usually in cavities in live trees or snags, but also under loose bark or within tree cracks or crevices."

Bat Habitat



Woodlands with Potential Bat Habitat

In Saskatchewan, Willis and Brigham (2005) found that hoary bats selected as roost trees conifers of similar size to the overall forest canopy that were protected from the wind. Because these species roost in woodlands of all types, bat roosting habitat is indexed by woodland cover types for the purposes of this report.

Wind projects planned in or near woodlands will thus have a greater likelihood of high bat mortality rates. Some of the highest levels of bat mortality were recorded at the Mountaineer wind power facility in the forested mountains of West Virginia, where an estimated 21 bats per night were struck (Horn et al. 2008). Nicholson (2003) reported an estimated 28.5 bats per turbine per year killed at the Buffalo Mountain wind farm in Tennessee. Fiedler (2004) reported that bat fatalities in 2004 at a wind power facility in mixed hardwood forest in eastern Tennessee were an order of magnitude greater than at 8 other facilities in the region, and blamed siting on a prominent ridgeline surrounded by forests with rocky outcrops for the higher bat mortality at this site and the Mountaineer wind farm. The National Research Council (2007) found that bat fatalities are higher for eastern sites on forested ridges, although similarly high fatality rates have been shown for croplands in Iowa and southwestern Alberta. Johnson et al. (2004) found that turbines located near woodlands also experienced higher levels of bat activity at the Buffalo Ridge facility in southwestern Minnesota. Arnett (2005) hypothesized that hoary bats may confuse turbine movements for flying insects and be drawn toward operating turbine blades, and that foraging areas such as forests may be particularly problematic in this regard.

Silver-haired bat.
J. Scott Altenbach photo.

Arnett (2005) found that bat fatalities were concentrated at both the ends and centers of turbine strings. Numerous studies have found that bat fatalities at turbines lit by red FAA lights and unlit turbines were similar (see, e.g., Johnson et al. 2004, Arnett 2005, Horn et al. 2008).

Best Practices for Bats

Siting Turbines in Open Habitats Rather Than Woodlands

Placement of wind power facilities in woodlands should be undertaken with great caution, and old-growth forests should be avoided entirely. Wind turbines sited at least 1 mile from woodland habitats, whether they be cottonwood, conifer, or aspen, will have lower probability of high bat mortality rates. Acoustic, radar, and/or thermal imaging surveys for bats should be undertaken to determine population sizes and occupied habitats for hoary and silver-haired bats in and near the project area prior to site selection, and foraging habitats and migration pathways used by these species. Turbine arrays should be designed to avoid identified areas of concentrated bat use.

Bat Mortality Monitoring

Bat mortality monitoring should be a standard protocol for wind turbine operations. Arnett (2005) reported that weekly carcass searches underestimated fatality rates due to high scavenger removal rates, and this researcher recommended carcass searches rotating through a subset of the turbines, so that there are some carcass data coming in each day.

Shutdowns to Avoid Bat Migrations

Johnson et al. (2004) found that bat mortalities are highest in late summer and early fall, coincident with migration periods. If turbines are sited across migration routes or between roosting and feeding areas, then these turbines should have seasonal shutdowns during the migration season(s) or periods.

Gearing Turbines to Cut In a 6 Meters per Second

In low-wind conditions, bats may not detect turbine blades in time to avoid collisions (Kunz et al. 2007a). Arnett (2005) found that bat fatalities occurred more often on low-wind nights when turbines were still operating, and fatalities increased just before and after the passage of storm fronts. In a later study, Arnett et al. (2008) reported elevated bat mortality from turbine collisions when wind speeds are light (<6 km/hr) and before and after the passage of storm fronts. Cryan (2008) recommended increasing blade ‘cut-in’ speed to wind velocities greater than 6 meters per second and mandatory shutdown during high-risk periods or seasons. Thus, turbines should be set to have a minimum ‘cut-in’ speed of 6 meters per second to avoid the increased mortality risk to bats at slow turbine speeds.

Conservation of Sage Grouse and Sharp-tailed Grouse

Sage grouse and sharp-tailed grouse may be negatively impacted by wind energy development, not so much from the standpoint of direct mortality from collisions but from displacement from favored habitats due to behavioral avoidance of tall structures. Much of what is known about the tolerance of sage grouse to industrial development derives from studies on oil, gas, and coalbed methane development. Sage grouse have lost the vast majority of their original population numbers and are sensitive to human disturbance; the same can be said of the Columbian sharp-tailed grouse, which has a small population in Wyoming in the foothills of the Sierra Madre Range. To the extent that wind power development also involves habitat fragmentation, road construction, and human activity and vehicle traffic associated with maintenance, some of the impacts recorded in the context of oil and gas development may apply to varying degrees to wind power developments.

The area within 2 or 3 miles of a sage grouse lek is crucial to both the breeding activities and nesting success of local sage grouse populations. One scientist described the lek site as "the hub from which nesting occurs" (Autenreith 1985). Grouse exhibit strong fidelity to individual lek sites from year to year (Dunn and Braun 1986). During the spring period, male habitat use is concentrated within 2 km of lek site (Benson et al. 1991). A Montana study found that no male sage grouse traveled farther than 1.8 km from a lek during the breeding season Wallestad and Schladweiler 1974). Other researchers found that 10 of 13 hens nested within 1.9 miles of the lek site during the first year of their southern Idaho study, with an average distance of 1.7 miles from the lek site; 100% of hens nested within 2 miles of the lek site during the second year of this study, with an average distance from lek of 0.5 mile (Hulet et al. 1986). In Montana, Wallestad and Pyrah (1974) found that 73% of nests were built within 2 miles of the lek, but only one nest occurred within 0.5 mile of the lek site. Holloran (2005 found that 64% of sage grouse nested within 3.1 miles of a lek in western Wyoming, and Walker et al. (2007) found that sage grouse habitat within 4 miles of a lek site was important to the persistence of the lek. Because leks sites are used traditionally year after year and represent selection for optimal breeding and nesting habitat, it is crucially important to protect the area surrounding lek sites from impacts.

Male sage grouse in breeding display. Jim Laybourn photo.

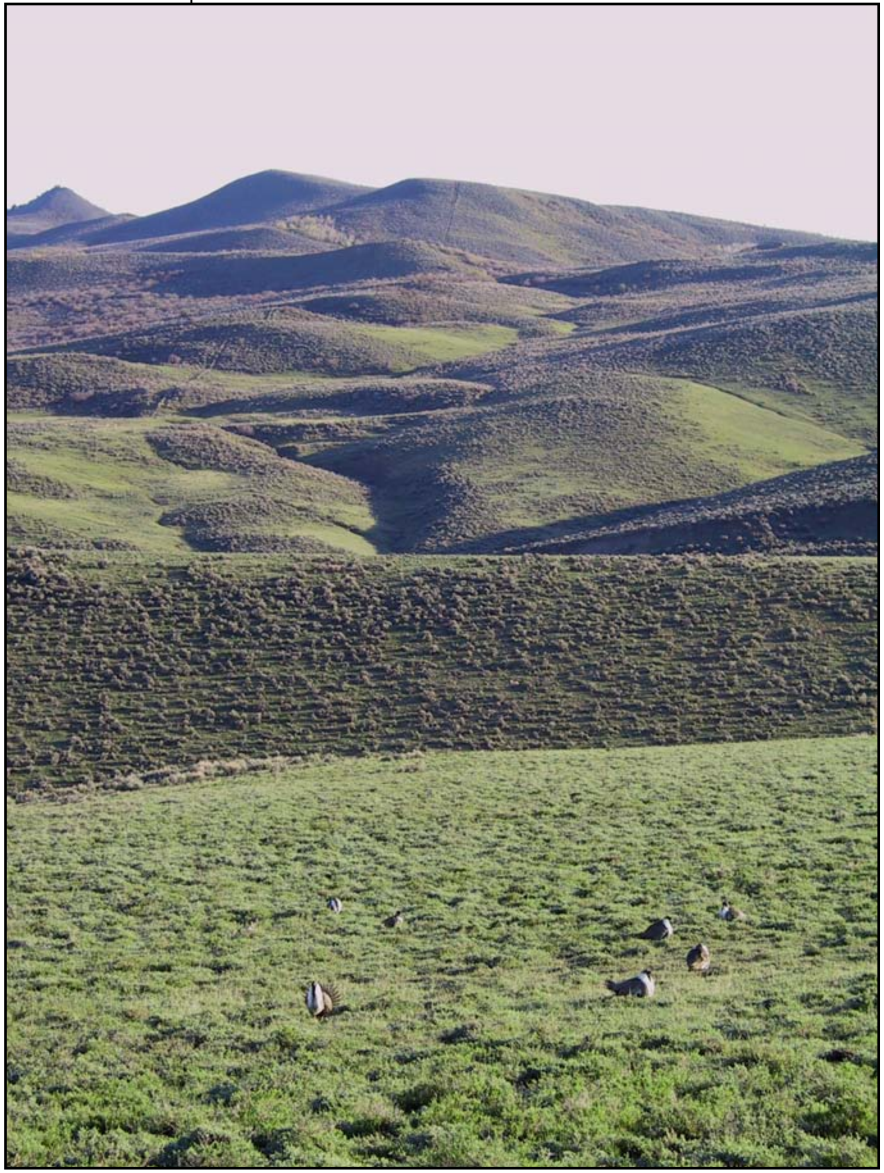
Sharp-tailed grouse concentrate nesting activity even closer to the lek site, and areas within one mile of lek sites are of disproportionate importance as nesting habitat. Nielsen and Yde (1982) found that sharp-tailed grouse concentrate their use within one mile of lek sites during spring, summer, and fall, and wintered in coulees where hardwood shrubs were prevalent. In another study, all grouse nest sites were within 1.1 km of a lek site (Marks and Marks 1987). Geisen and Connelly (1993) reported that a 2 km buffer around a lek forms a 95% probability ellipse for relocating sharp-tailed grouse. Nielsen and Yde (1982) recommended protecting both wintering areas and areas within a mile of lek sites from heavy cattle concentrations, and to locate reservoirs at least a mile away from draws with abundant woody vegetation. According to Saab and Marks (1992: 172), "Protecting habitats within 2.5 km of dancing grounds is critical for maintenance of summer habitat."

Although the impacts of wind energy development remain poorly understood, the impacts of oil and gas development on sage grouse have been well-studied. Like oil and gas development, wind energy development involves the construction of facilities and road networks, resulting in a level of habitat fragmentation that is similar to full-field oil and gas development. Wind turbines are very tall structures, and are therefore expected to trigger avoidance behaviors in grouse that may not come fully into play with oil and gas development except during the drilling stage. On the other hand, vehicle traffic may be less heavy in wind power facilities than in oil and gas fields, and thus the avoidance of wind farms due to vehicle traffic may be less than for oil and gas fields. Given the absence of rigorous scientific study of the impacts of wind farms on sage grouse, known impacts of oil and gas development may be instructive.

In August of 2008, the State of Wyoming adopted a new policy regarding the protection of sage grouse core areas across the state. Wyoming Executive Order 2008-2. This policy identifies specific core areas, shown on the map in blue outline, that include many of the largest sage grouse leks and the nesting habitat that surrounds them. According to this policy, "New development or land uses should be authorized or conducted only when it can be demonstrated by the state agency that the activity will not cause declines in Greater Sage-Grouse populations." As it cannot be determined that construction of wind turbines within five miles of an active lek will not cause population declines, these portions of the core areas have been labeled as red zones, whereas other parts of core areas have been noted as yellow zones where construction might be possible if great care and caution are exercised.

Lessons to be Learned from Oil and Gas Development

In a study near Pinedale, sage grouse from disturbed leks where gas development occurred within 3 km of the lek site showed lower nesting rates (and hence lower reproduction), traveled farther to nest, and selected greater shrub cover than grouse from undisturbed leks (Lyon 2000). According to this study,



Sage grouse strutting at a lek site, Little Snake River valley. BCA photo.

impacts of oil and gas development to sage grouse include (1) direct habitat loss from new construction, (2) increased human activity and pumping noise causing displacement, (3) increased legal and illegal harvest, (4) direct mortality associated with reserve pits, and (5) lowered water tables resulting in herbaceous vegetation loss. Pump and compressor noise from oil and gas development may

Map Legend

5-mile sage grouse lek buffers including 65% of state grouse populations	Sage grouse 5-mile lek buffers, 85% pop.
Sage grouse 5 mile lek buffers, 70% pop.	Sage grouse 5-mile lek buffers, 100% pop.
Sage grouse 5-mile lek buffers, 75% pop.	Sharp-tailed grouse lek
Sage grouse 5-mile lek buffers, 80% pop.	Plains sharp-tailed grouse 5-mile lek buffers
	Columbian sharp-tailed grouse leks and 5-mile buffer

reduce the effective range of grouse vocalizations; low-frequency noise from wind turbines could have a similar effect. A consortium of eminent sage grouse biologists recommended, "Energy-related facilities should be located >3.2 km from active leks." And Dr. Clait Braun, the world's most eminent expert on sage grouse, has recommended even larger NSO buffers of 3 miles from lek sites, based on the uncertainty of protecting sage grouse nesting habitat with smaller buffers.

Walker et al. (2007) found that coalbed methane development within 2 miles of a sage grouse lek had negative effects on lek attendance. Holloran (2005) found that active drilling within 3.1 miles of a lek reduced breeding populations, while wells already constructed and drilled within 1.9 miles of the lek reduced breeding populations. Both Holloran (2005) and Walker et al. (2007) documented the extirpation of breeding populations at active leks as a result of oil and gas development in the Upper Green River Valley and Powder River Basin, respectively. Road construction related to energy development is a primary impact on sage grouse habitat from habitat fragmentation and direct disturbance perspectives. Rowland et al. (2006: 5-10) modeled sage grouse distribution, and reached the following conclusions:

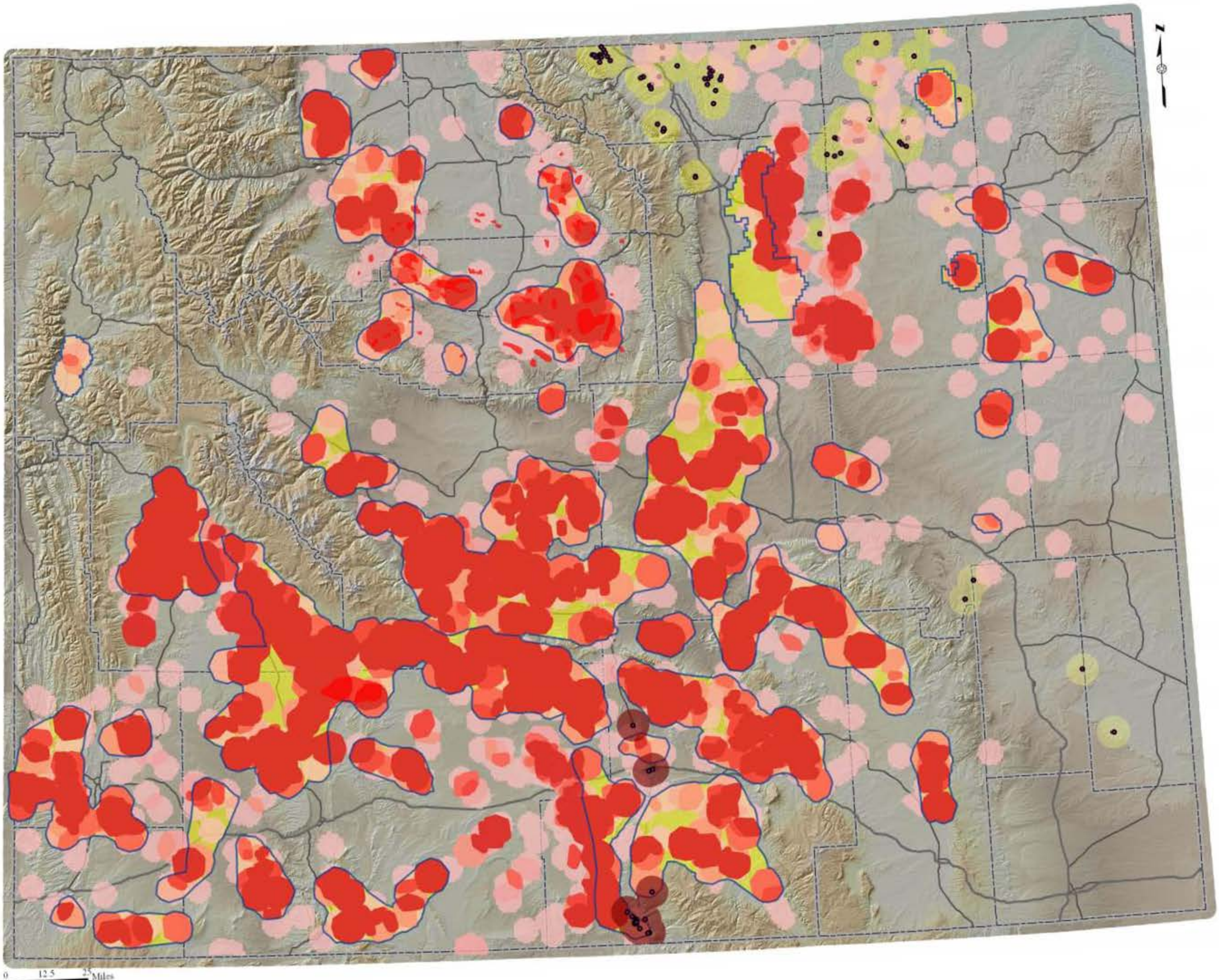
> "The secondary road network is a highly significant factor influencing processes in this landscape and is being developed and expanded rapidly across much of the WBEA. Secondary roads are being built as part of the infrastructure to support non-renewable energy extraction. For example, within the Jonah Field in the Upper Green River Valley, >95% of the area had road densities >2 mi/mi^2."

(Internal citations omitted). Furthermore,

> "The dominant feature affecting output of the sage-grouse disturbance model was secondary roads, which occupy nearly 8% of the study area (Table 5.2) and are presumed to negatively influence an even larger extent."

Pp. 6-15 through 16. Holloran (2005) found significant impacts of road traffic on sage grouse habitat use in the Pinedale Anticline gas field, concluding that habitat effectiveness declined in areas adjacent to roads with increasing vehicle traffic, documenting the secondary effect referenced by Rowland et al (2006).

Sage Grouse and Sharp-Tailed Grouse



Anemometer Towers and Sage Grouse: A Case Study

Even the erection of anemometer towers to test for wind energy potential can cause abandonment of key sage grouse habitats, as exemplified by the Cotterel Mountain wind project in Idaho. Windland Incorporated was granted rights-of-way by BLM to construct 7 meteorological towers, 30 to 150 feet in height and topped with anemometers to measure wind velocity for a commercial wind power feasibility study, along the length of Cotterel Mountain, Idaho in July of 2001 (BLM 2001). Anemometers went into operation the same year (Windland Inc. 2005). In October of 2003, permission to construct an eighth tower was granted (BLM 2003). As of 2003, there were 9 known sage grouse leks on Cotterel Mountain, five of which were newly identified that year (Reynolds 2004). On average, 21.5 birds were observed on the leks as a whole, and five leks were used consistently by breeding birds, with a population estimated at less than 50 breeding males (Id.). Overall population estimates were 64 to 72 individuals in 2004 and 59 to 66 individuals in 2005 (Reynolds and Hinckley 2005). In spring 2006, the population of sage grouse on Cotterel Mountain had declined to and estimated 16 individuals and seven of nine leks were unoccupied, while sage grouse populations elsewhere in the county exhibited steady population trends in 2004 and 2005 and only a very slight dip in 2006 (Collins and Reynolds 2006). It is instructive that the Cotterel Mountain sage grouse population crashed following installation of anemometer towers across the crest of Cotterel Mountain, while populations elsewhere in Cassia County held relatively steady.

Juvenile sage grouse near Baggs, Wyoming. BCA photo.

Best Practices for Grouse

Avoiding Turbine Construction in Breeding, Nesting, and Winter Habitats

Because wind turbines represent tall structures which sage grouse are believed to avoid behaviorally, the erection of a wind power facility in or adjacent to sage grouse habitat potentially leads to the abandonment of that habitat by grouse. For this reason, the USFWS (2003, *and see* Manville 2004) recommends siting wind turbine facilities at least 5 miles away from the leks of prairie grouse, which include the sage grouse and sharp-tailed grouse. We support these recommendations and the precautionary approach they adopt in the absence of firm evidence that utility-scale wind power generation is compatible with maintaining sage grouse habitat function. The same caution should apply to known wintering habitats. Areas within 5 miles of sage grouse leks and Columbian sharp-tailed grouse leks are shown as avoidance areas on the accompanying map, while Plains sharp-tailed grouse leks are buffered by yellow caution areas in which scientific study should be conducted for the first wind power facility within 5 miles of a lek and subsequent construction in such habitat should occur contingent on a finding that impacts on sharp-tailed grouse are negligible. We also recommend avoiding the erection of anemometer stations within 5 miles of active sage grouse leks.

Burying Powerlines in Grouse Breeding, Nesting, and Winter Habitats

Transmission towers serve as perches for hunting raptors (as discussed in the section on Wind Power Potential and Siting Considerations) in addition to potentially causing abandonment of sage grouse habitats through behavioral avoidance. An unpublished study found that sage grouse habitat use increased with distance (up to 600 meters) from powerlines (Braun, unpublished data, in Strickland 2004). All transmission lines (including high-voltage DC lines) sited within 5 miles of a grouse lek, within ½ mile of winter habitat, or through Core Areas identified by the recent Wyoming Executive Order should be buried. We recommend avoiding active sage grouse and Columbian sharp-tailed grouse leks by not less than 5 miles from sage grouse leks unless the turbines would be masked from view of the lek by intervening topography. Plains sharp-tailed grouse are not considered to be rare, and thus we recommend caution within 5 miles of lek sites, and providing monitoring studies to determine effects when wind power facilities are sited this close.

Big Game

There have been no scientifically rigorous hypothesis tests concerning the impacts of wind energy development on big game. There is some anecdotal information that pronghorn and even elk may continue to use the Foote Creek Rim wind power site, but this area has not been subjected to rigorous scientific study. According to NWCC (2002:27), “Wind farms also may disrupt wildlife movements, particularly during migrations. For example, herd animals such as elk, deer and pronghorn can be affected if rows of turbines are placed along migration paths between winter and summer ranges or in calving areas.” It is widely agreed that construction-related activities are likely to displace wildlife from their native ranges. The impacts of energy development on elk and (to a lesser extent) mule deer have been studied, but for other big game animals, it will be necessary to infer potential impacts using the studied species until more specific scientific research can be conducted.

A number of studies have shown that elk avoid open roads (Grover and Thompson 1986, Rowland et al. 2000). Edge and Marcum (1991) found that elk use was reduced within 1.5 km of roads, except where there was topographic cover. Gratson and Whitman (2000) found that hunter success was higher in roadless areas than in heavily roaded areas, and that closing roads increased hunter success rates. On the Black Hills, elk chose their day bedding sites to avoid tertiary roads and even horse trails (Cooper and Millspaugh 1999). Cole et al. (1997) found that reducing open road densities led to smaller elk home ranges, fewer movements, and higher survival rates. Road networks associated with wind development would be expected to displace elk, and thus wind power facilities should avoid the most sensitive habitats and migration corridors.

Pronghorns near Delaney Rim. Ron Marquart photo.

On winter ranges, elk are highly susceptible to disturbance. They are so sensitive to human disturbance that even cross-country skiers can cause significant stress to wintering animals (Cassirer et al. 1992). Ferguson and Keith (1982) found that while cross-country skiers did not influence overall elk distribution on the landscape, elk avoided heavily-used ski trails. Disturbance during this time of year can be particularly costly, since the metabolic costs of locomotion are up to five times as great when snows are deep (Parker et al. 1984). To the degree that wind power facilities involve human presence in crucial ranges during the most sensitive time periods, these developments may tend to displace elk from their preferred habitats into marginal ranges, where habitat conditions may be poor or where they may be forced to compete with resident animals already at or near their carrying capacity.

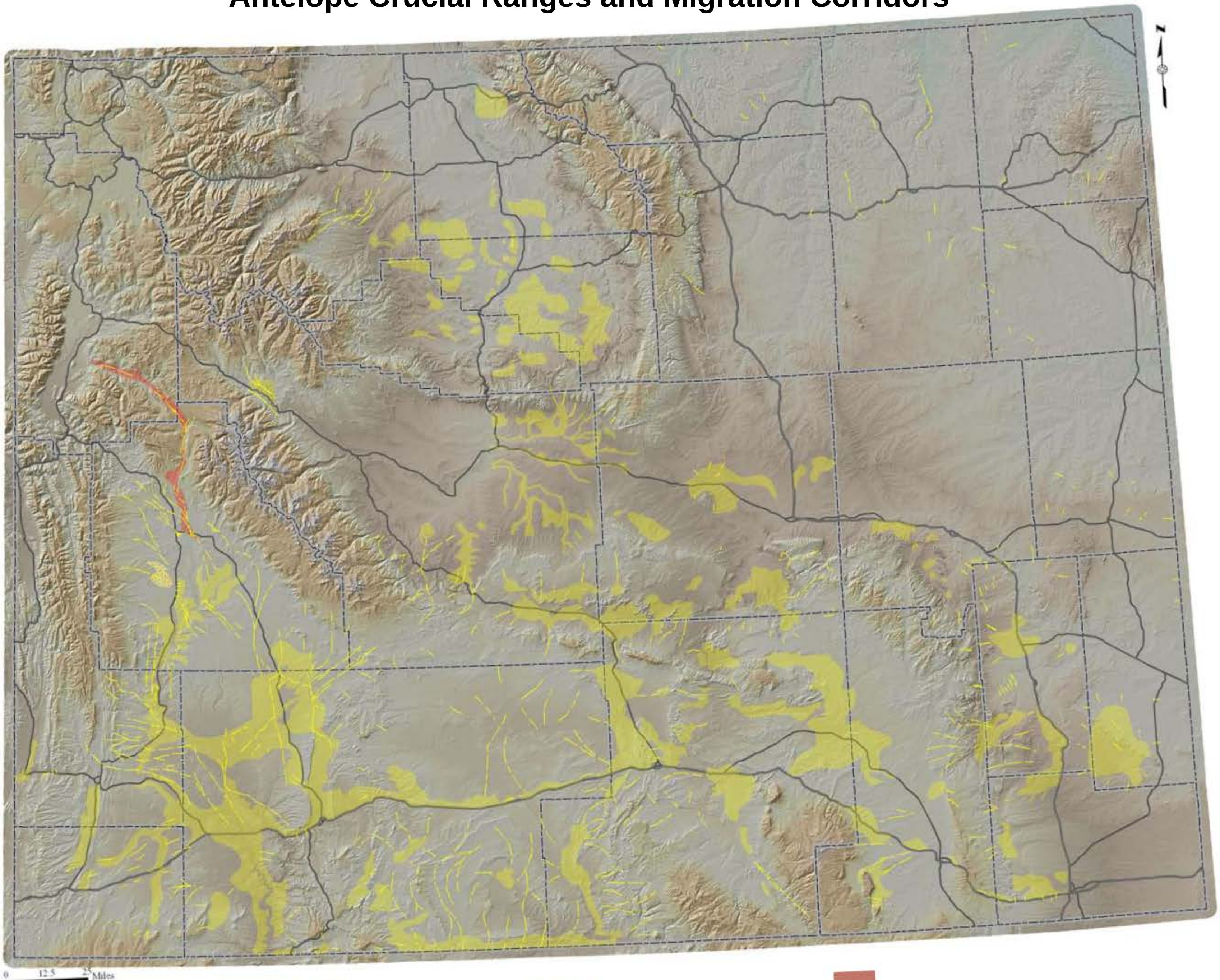
Several studies have shown that elk abandon calving and winter ranges in response to oilfield development, with potential implications for utility-scale wind power development. In mountainous habitats, the construction of a small number of oil or gas wells caused displacement of elk from substantial portions of their winter range (Johnson and Wollrab 1987, Van Dyke and Klein 1996). Drilling in the mountains of the Wyoming Range displaced elk from their traditional calving range (Johnson and Lockman 1979, Johnson and Wollrab 1987). Powell (2003) found that elk avoid lands within 1.5 kilometers of roads and gas well sites in summer and within 0.6 mile in winter in the sagebrush habitats of the Red Desert, and Sawyer and Neilson (2005) found the same results for response to roads for their subsequent investigation in the same area.

For mule deer, Sawyer et al. (2005) found that in the Pinedale area, wellfield development caused abandonment of mule deer crucial winter ranges for years at a time, and ultimately resulted in a 46% decline in mule deer populations, while herds in undeveloped areas showed a much smaller decline over the same period; the affected population has yet to recover to predisturbance levels.

Migration corridors may in some cases be equally important to large mammals and are potentially susceptible to impacts from wind energy development. Our maps show migration corridors designated by the Wyoming Game and Fish Department, but in a few cases more detailed migration corridor locations have been generated by studies using Global Positioning System tracking collars that take reading via satellite (e.g., Berger et al. 2007, Sawyer 2007). In the context of oil and gas development, the Piney Front Elk Study demonstrated that oil and gas development could pose a barrier to elk migration, denying herds access to crucial winter ranges (F.W. Lindzey, pers. comm.). The Western Governor’s Association (2008) has adopted a Wildlife Corridors Intiative that specifically addresses the conservation of migration corridors in the context of renewable energy development:

> “In particular, WGA, in coordination with the WWHC [Western Wildlife Habitat Council], should ensure that development of the renewable energy zones 1) includes identification of relevant wildlife corridors and crucial habitat from the relevant state DSS [Decision Support System], and 2)

Antelope Crucial Ranges and Migration Corridors



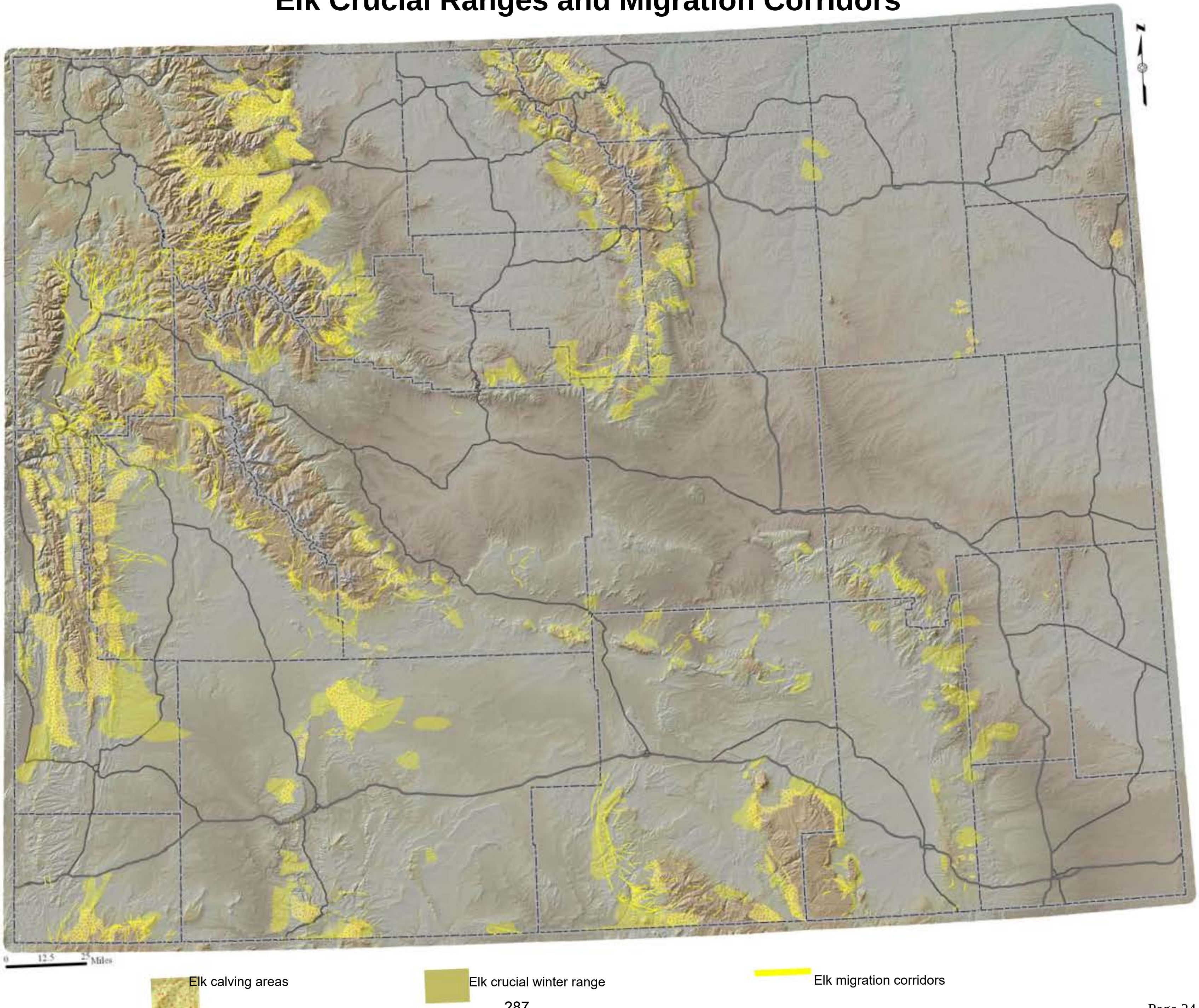
Antelope Parturition Habitats

Antelope crucial winter range

Antelope migration corridors

Northern portion, Grand Teton antelope migration corridor

Elk Crucial Ranges and Migration Corridors



considers appropriate policies and actions to avoid, minimize, or mitigate impacts in these sensitive areas."

With this in mind, we have labeled identified big game migration bottlenecks identified for the Upper Green River Basin as avoidance areas and recommend caution when siting wind energy facilities, and migration routes should be accorded similar level of conservation as winter and parturition ranges.

Best Practices for Big Game Crucial Ranges and Migration Corridors

Test Initial Projects before Approving Additional Development in Crucial Habitats

The first projects to be constructed within big game crucial ranges or migration corridors should be accompanied by rigorous scientific studies to determine the level of tolerance of big game for wind power facilities. These studies should test the null hypotheses that construction activities have no effect on wildlife habitat selection and describe the area of avoidance if displacement occurs; test the same hypothesis for operation activities; determine population-levels effects, if any; and determine how long it takes for animals to resume using the wind power facility site. Such studies should use Before-After-Control formats for maximum scientific rigor. If these studies indicate that displacement of big game by wind power development from a type of sensitive range or migration corridor is negligible, then other wind power projects should be free to proceed in that type of range or migration corridor.

Perform Construction Activity Outside the Sensitive Season

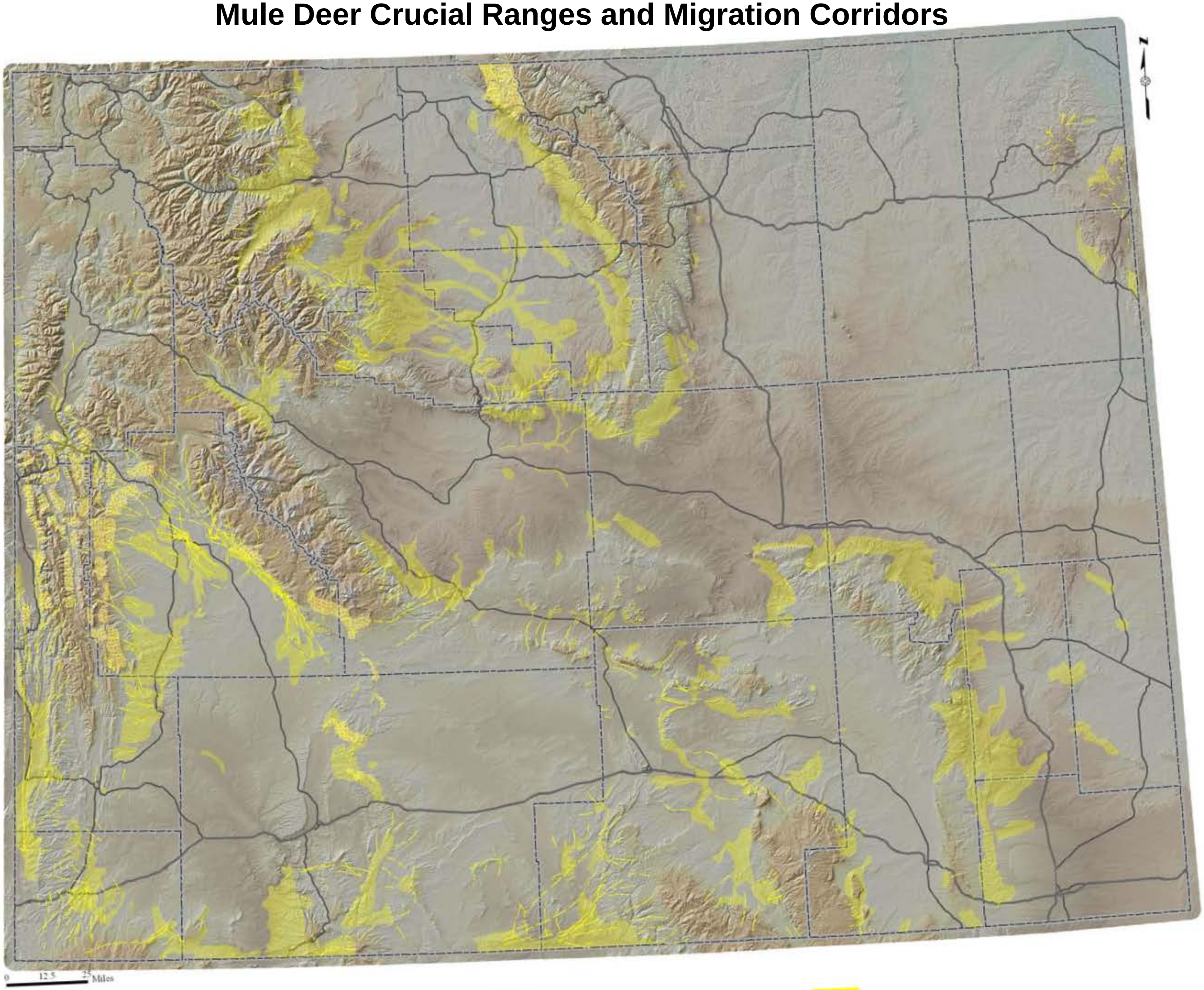
Within 2 miles of crucial ranges or migration corridors, wind power facility construction activities should occur outside their period of use by wildlife.

Seasonally Restrict Vehicles and Human Presence

Portions of the wind energy facility inside crucial winter ranges or migration corridors should be closed to vehicle use (and human presence must be minimized) during their period of use by wildlife.

Above: *Elk along Parnell Creek, Jack Morrow Hills. BCA photo.*
Below: *Pronghorn near the Shirley Mountains. George Weurthner photo.*

Mule Deer Crucial Ranges and Migration Corridors

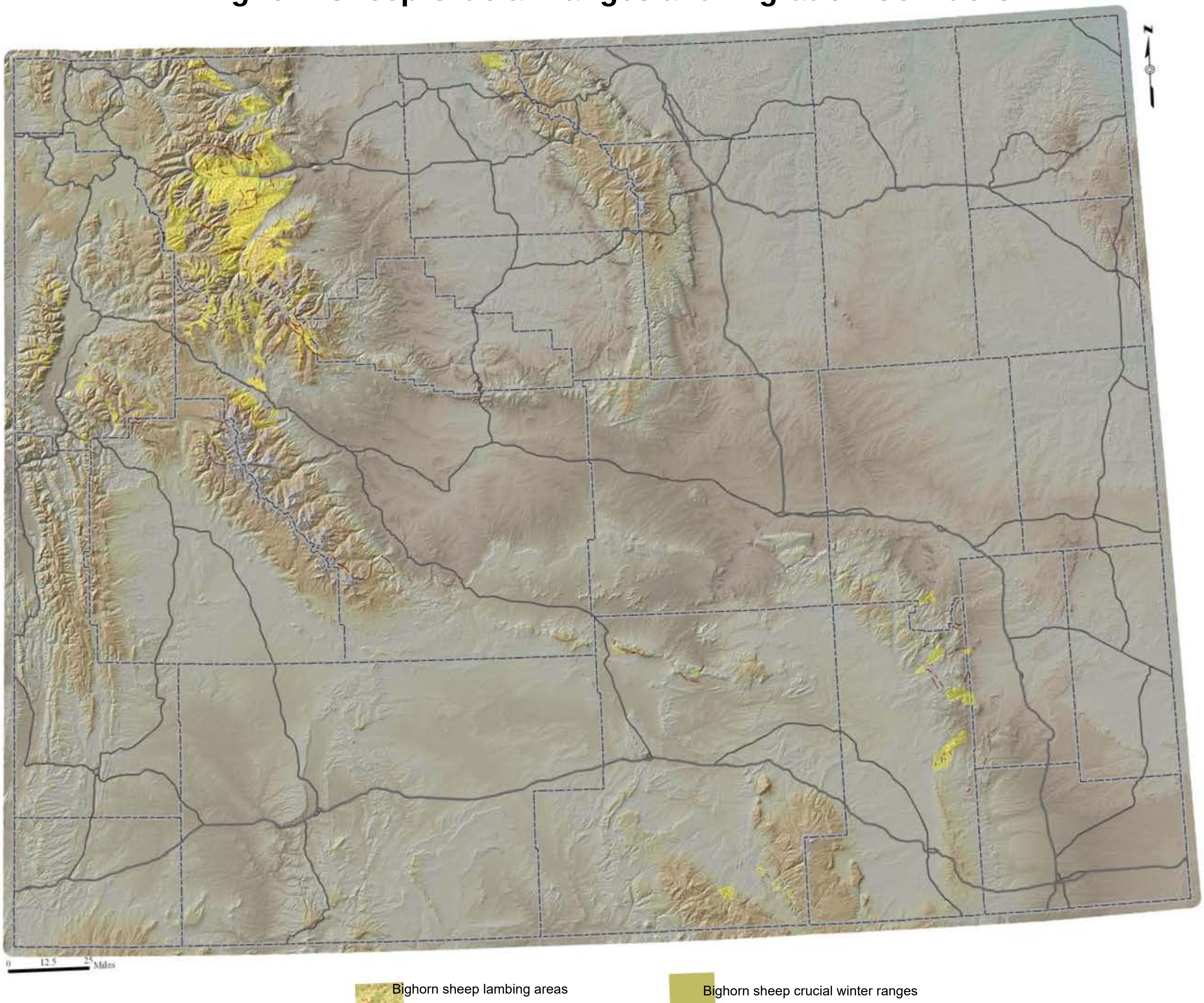


Mule deer parturition areas

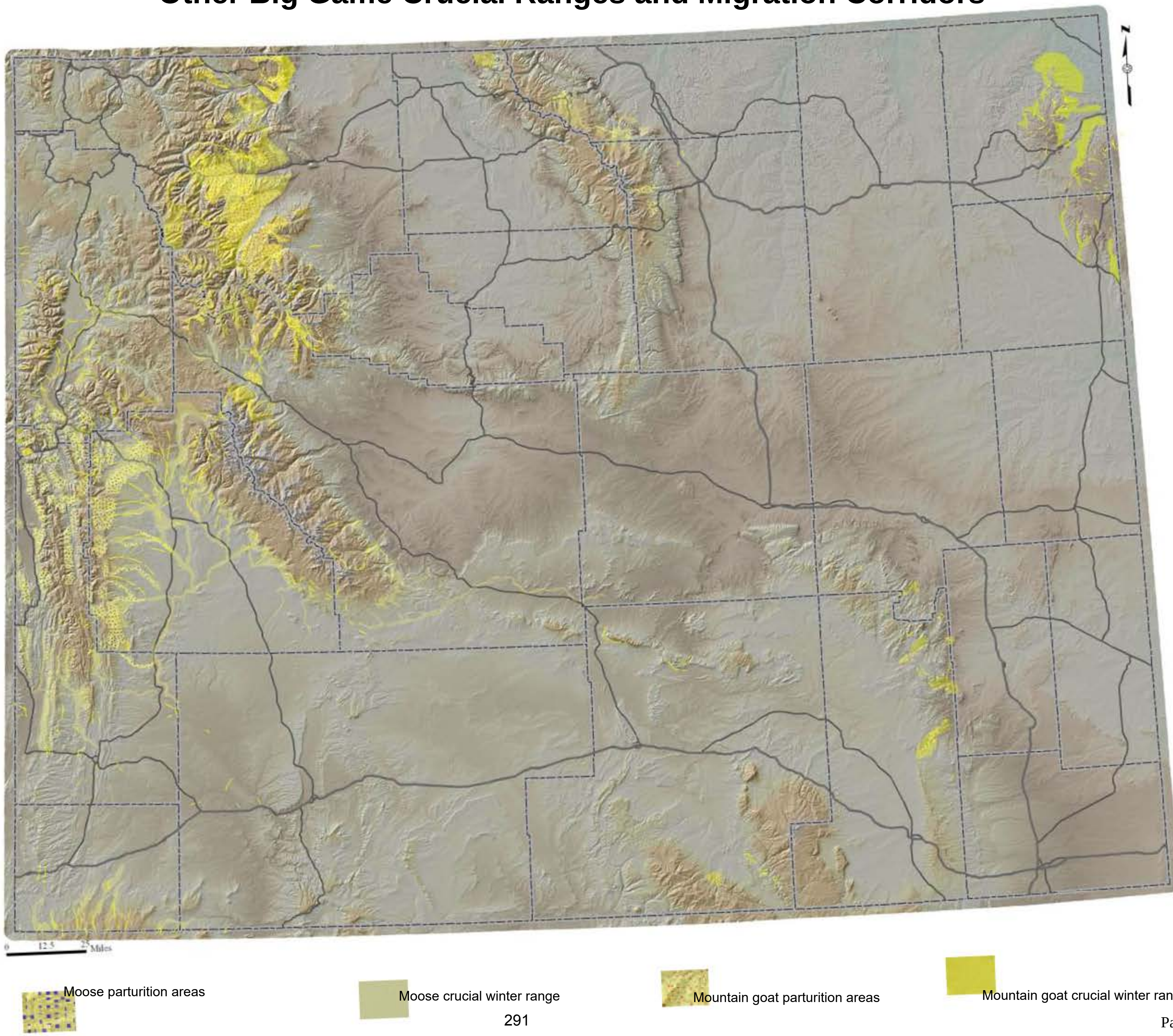
Mule deer crucial winter range

Mule deer migration corridors

Bighorn Sheep Crucial Ranges and Migration Corridors



Other Big Game Crucial Ranges and Migration Corridors



Stewardship for Other Sensitive Wildlife

Wind power projects can affect sensitive wildlife through direct mortality, habitat loss and fragmentation, and displacement of wildlife from preferred habitats due to disturbance. The key to minimizing these impacts is to site wind power facilities in areas of relatively low habitat importance and low likelihood of conflict.

Direct Mortality of Migratory Birds

Wind turbines arrays have the potential to be major sources of migratory bird mortality. Birds have relatively poor hearing, and human ears can detect wind turbines at roughly twice the distance as birds can (Dooling 2002). McCrary et al. (1983, 1984) estimated that 6,800 birds were killed annually at the San Gorgonio wind facility in California. Erickson et al. (2001) reported than in a California study, 78% of mortalities were songbirds protected by the Migratory Bird Treaty Act, while only 3.3% of bird mortalities were unprotected, non-native species such as rock doves or starlings. At Wyoming's Foote Creek Rim wind facility, 92% of bird mortality between 1998 and 2002 was comprised of passerines, or small songbirds (Young et al. 2003).

The sage thrasher (above) and green-tailed towhee (at right) are two songbird species considered sensitive to habitat fragmentation. US Fish and Wildlife Service photos.

Kerns and Kerlinger (2004) reported the largest single bird mortality event at the Mountaineer facility in West Virginia in 2003. The mortality event was associated with a brightly lit substation in foggy conditions; the lights were subsequently turned off and no further large mortality events were reported for the site.

While it is correct to point out that many other types of human activities have killed substantially more birds than have wind turbines to date, fatalities from turbine collisions are additive to all other stressors of bird populations, which may already be imperiled by other human-caused factors. The National Research Council (2007) points out that while turbine fatalities are a small portion of human-caused bird mortalities nationwide, but locally these mortalities can have important impacts on bird populations.

Woodlands may have greater sensitivity from the perspective of songbird mortality. The National Research Council (2007:53) found that "Total bird fatalities per turbine and per MW [megawatt] are similar for all regions examined in these studies, although data from the two sites evaluated in the eastern United States suggest that more birds may be killed at wind-energy facilities on forested ridge tops than in other regions." This is not always the case, however: not one dead bird was found by Keppinger (2002) during mortality monitoring at a Vermont turbine facility sited in rolling forested country.

Nocturnal migrations of songbirds should be identified as part of the baseline analysis for wind power projects. Bird migrations often occur at night (Mabee et al. 2006). The highest percentage of fatalities attributable to nocturnal migrants was 48% at Wyoming's Foote Creek Rim wind power facility (Erickson et al. 2001). Wind turbines extend into the lowest strata of bird migration; most migrating birds fly at heights above turbine facilities (Kerlinger 2002). Birds may maintain altitude after crossing ridgetops (Mabee et al. 2006), suggesting that wind turbine arrays with the tops of blades positioned lower than nearby ridgetops could result in lower rates of mortality for migratory birds.

Accurate mortality monitoring and before-and-after habitat use studies should be a basic part of all wind facility operations, and have been for many wind power programs to date. Estimates of bird mortality can be biased by the efficiency of searchers to locate dead birds and by the rates at which scavengers remove the carcasses. Both of these factors vary widely among wind power sites (Morrisson 2002). Searcher efficiency at the Foote Creek Rim was estimated at 90% for medium and large birds and 60% for small birds based on experimental trials (Young et al. 2003). Arnett (2006) found that trained dogs had a much higher efficiency of finding bird mortalities (71-81%) versus human searchers (14-40%) in the eastern US.

Habitat Impacts for Birds

Wind turbine arrays are likely to result in habitat fragmentation and the displacement of sensitive wildlife away from developed areas. Leddy et al. (1999) found that the Buffalo Ridge wind project area had a density of grassland passerines four times lower than surrounding habitats, indicating that songbirds avoid wind turbine arrays in their habitat selection. In Wyoming, Sensitive Species such as the sage sparrow, Brewer's sparrow, and sage thrasher, and site the project in such a way that impacts can be minimized.

Fragmentation of shrubsteppe habitats has a particularly strong negative impact on birds. Knick and Rotenberry (1995:1059) found that sage sparrows and sage thrashers decreased with decreasing patch size and percent sagebrush cover, and reached the following conclusion:

> Our results demonstrate that fragmentation of shrubsteppe significantly influenced the presence of shrub-obligate species. Because of restoration difficulties, the disturbance of semiarid shrubsteppe may cause irreversible loss of habitat and significant long-term consequences for the conservation of shrub-obligate birds.

Kerley (1994) found that small patches had fewer shrub-nesting species than large patches, and the green-tailed towhee, an interior sagebrush species, was entirely absent from small patches.

Wind turbine facilities sited in forested locations can contribute to forest fragmentation, potentially displacing interior forest species. The Searsburg facility in Vermont showed a decline in interior forest birds and an increase in edge-adapted birds such as robins and jays using the area, likely associated with the clearings constructed for turbine towers and roads (Kerlinger 2002).

Morrisson (2006) summed up habitat impacts as follows: "For wind developments, issues of habitat involve (1) outright loss because of development, (2) indirect impacts because of disturbance (i.e., the animal will no longer reside near the development), and (3) disruption in animal passage through or over the development because of the addition of towers and turbines." The American Society of Mammalogists (2008) has recognized that wind power projects lead to habitat fragmentation and wildlife displacement. Many of these impacts are avoidable through proper siting, according to the National Research Council (2007): "To the extent that we understand how, when, and where wind-energy development most adversely affects organisms and their habitat, it will be possible to mitigate future impacts through careful siting decisions." Another important factor is indirect habitat loss as a result of increased human presence, noise, or motion of operating turbines, according to the National Wind Coordinating Council (NWCC 2002).

Above: *Nesting mountain plover. Fritz Knopf photo.*

At right: *Black-tailed prairie dogs. Rich Reading photo.*

Beginning in 1994, federal and state agencies began to partner with bird conservation organizations under the Intermountain West Joint Venture, and together these stakeholders identified a number of Bird Habitat Conservation Areas that became priorities for federal funding (Intermountain West Joint Venture 2005). These areas were established to focus conservation efforts on priority birds and habitats. The Wyoming conservation plan incorporates the Audubon Society's Important Bird Areas, a smaller subset of the Bird Habitat Conservation Areas (id.). The Bird Habitat Conservation Areas are marked in yellow on the map as areas where wind power projects should be implemented with special sensitivity to bird conservation.

The Mountain Plover: A Species of Special Concern

The project area should be thoroughly surveyed for mountain plover nesting habitat, and identified nesting areas should be excluded from the project. On the nearby Foote Creek Rim facility, wind turbine development along the southern part of the rim caused the area to be abandoned as nesting habitat by mountain plovers. Johnson et al. (2000) showed a steady decline in estimated population of breeding mountain plovers along the Foote Creek Rim from 60 in 1995 to 18 in 1999. Plover nesting activity also appeared to be displaced from areas where construction activity was underway (id.). According to this study,

> Reduced use of the southern portion of Foote Creek Rim by mountain plovers may be related to behavioral avoidance of operating turbines and/or construction and maintenance activities, reduced habitat effectiveness caused by the presence of roads, turbine pads, and other ground disturbance, or a combination of the above (Johnson et al. 2000: 31).

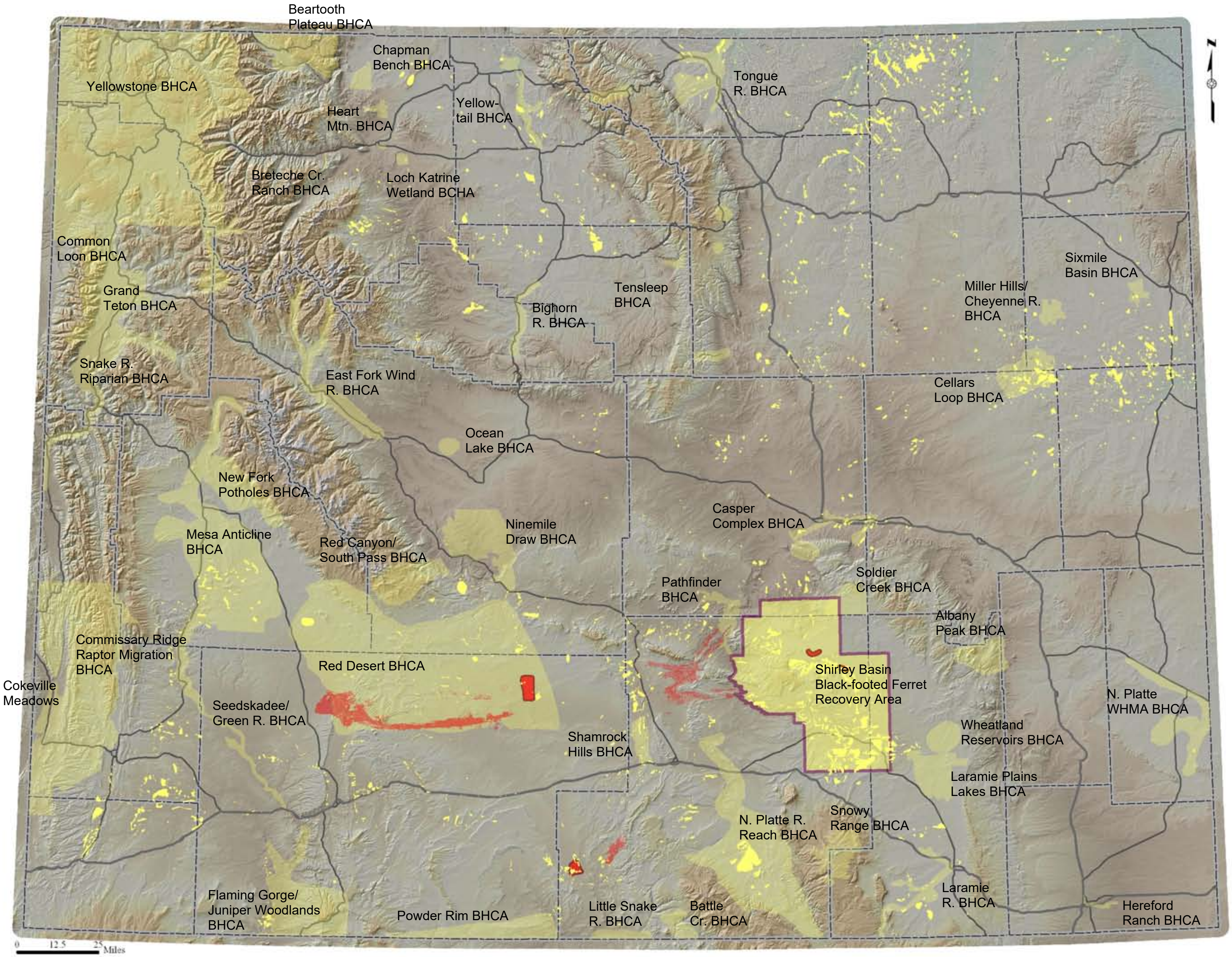
Rates of nest success also declined over this period, compounding the impacts of fewer nesting pairs (*id*.). Identification of key nesting habitats and siting turbine facilities to avoid them will be key to minimizing impacts to this species.

Small Mammals

Impacts of wind power projects to burrowing rodents are uncertain. Some studies indicate that wind power development can be compatible with burrowing mammals. At Altamont Pass, some species of burrowing rodents and rabbits clustered around turbine towers, attracting foraging raptors (Smallwood and Thelander 2005). Johnson et al. (2000) found that populations of prairie dogs and ground squirrels showed no apparent decline in response to wind turbine construction and operation at Foote Creek Rim.

On the other hand, fragmenting small mammal habitat can have negative consequences. Katzner (2004) noted that habitat fragmentation can reduce the size, stability and success of pygmy rabbit populations because these animals are reluctant to cross open habitats. Roads and wellpads clearly fall into this category. Purcell (2006: 34) noted, "the conversion of big sagebrush communities to energy production sites within southwestern and southcentral Wyoming creates a concern for pygmy rabbits in these regions."

Sensitive Wildlife Habitats



In Wyoming, the Wyoming pocket gopher, pygmy rabbit, and white-tailed prairie dog are of particular concern, as is the Endangered black-footed ferret, which depends virtually entirely on prairie dog colonies for habitat and prey.

Sand Dunes and their Unique Residents

Sand dune habitats are very rare features that typically support a unique assemblage of plants and animals that may be found in no other habitat. Bury and Luckenback (1983: 218) observed, "Dunes often lack adjacent or nearby colonization sources and much of the biota may be endemic," and made the following recommendations for the conservation of sand dune communities:

> "A paradigm for the management of desert dune systems should follow the recommendations of Whitcomb et al. (1976), who urge that ecological preserves be kept as large as possible because (1) large areas have low extinction rates and high immigration rates; (2) some taxa require very large areas for survival; (3) preservation of entire ecological communities, with all trophic levels represented, requires large areas; (4) large preserves are a better buffer against human disturbance; (5) large areas are necessary to minimize the predation, parasitism, and competition exerted by species abundant in the disturbed area surrounding reserves; (6) the failures of small reserves have been adequately documented; and (7) because fragmentation is irreversible, a conservative preservation strategy needs to be adopted."

According to the US Geological Survey (1996), "The highest priority should be given to protecting vegetated dunes, active sand dunes, forest-dominated riparian, shrub-dominated riparian and grass-dominated wetlands and riparian areas because their current protection is minimal and because they are potentially the most vulnerable to ongoing land management practices."

In Wyoming, the blowout penstemon, listed under the Endangered Species Act, is found only in active sand dune habitats bordering the Ferris Mountains. The lemon scurfpea – big sagebrush association is a rare plant community restricted to open dune habitats, and is found in the Killpecker Dune Field (BLM 2003). In Wyoming, Maxell (1973) found that scurfpea and ricegrass communities in the sand dunes contained the greatest kangaroo rat concentrations, and drew the following conclusion: "Kangaroo rats were almost exclusively restricted to the sand dunes and adjacent areas in the Basin" (p. 86). The vegetated sand dunes, active sand dunes, and graminoid-dominated "vernal pond" wetlands in this area all are rated "highest priority" for conservation by the Wyoming Gap study (USGS 1996). Thus, the conservation of actively migrating sand dune habitats is an important issue in Wyoming's cold deserts.

Map Legend

- Joint Ventures Bird Habitat Conservation Areas
- Mountain plover nesting concentration areas
- USFWS Black-footed Ferret Recovery Area
- Active prairie dog colonies

Best Practices for Other Sensitive Species

Conduct Pre-siting Wildlife Surveys to Determine Optimum Siting

Morrisson (2006) is one of many researchers that have conducted studies of bird habitat utilization and migration patterns in advance of wind energy development. By determining the habitat use on the project scale, turbines can be sited away from high-value bird habitats. This researcher concluded, "Such pre-siting surveys are needed to appropriately locate wind farms and minimize the impacts to birds." Such surveys should be applied generally, and will be particularly important for projects sited in Bird Habitat Conservation Areas.

Avoid Rodent Control Programs to Mitigate Raptor Mortalities

Rodent control programs to reduce prey availability have been ineffective in reducing raptor mortality at Altamont Pass (Smallwood and Thelander 2005, GAO 2005). Given the potential sensitivity of the rodent populations themselves in Wyoming, programs to reduce or eliminate rodent populations to reduce mortality rates of hunting raptors result in a net environmental loss.

Protecting Sand Dune Habitats

Wind power development in areas of actively migrating sand dunes has the potential to slow or alter wind patterns, resulting in the conversion of open dune habitats to dunes stabilized by vegetation. Keith et al. (2004) reported that large amounts of wind power can produce changes in climate at the continental scale

The Killpecker Sand Dunes in the heart of the Red Desert are the nation's largest actively migrating dune field. Ron Marquart photo.

by extracting kinetic energy and altering turbulent transport in the atmospheric boundary layer, with the result of slower wind speeds and greater turbulence near the surface. Roy et al. (2004) modeled the effects of wind farms in the Great Plains region and found that the wind farm significantly slows down the wind at the turbine hub-height level, and that turbulence generated by rotors creates eddies downwind of turbine arrays. In order to ensure that a reduction in wind velocity does not result in the stabilization of actively migrating dunes and the loss of open dune habitats, wind power projects should not be sited in or immediately upwind of areas of actively migrating dunes, marked in red on the accompanying map.

Requiring Unguyed Meteorological Towers

Meteorological towers associated with wind power facilities also can be a major source of avian and bat mortality. Guyed meteorological towers show a 3 times higher fatality rate than turbines themselves at Wyoming's Foote Creek Rim facility, with collisions with guy wires primarily responsible for bird deaths (Young et al. 2003). The Nine Canyon wind project in Washington used an unguyed meteorological tower, which resulted in no recorded bird or bat fatalities (Erickson et al. 2003). Meteorological towers should be of the free-standing, unguyed variety to minimize additional avian and bat mortality.

Avoiding Wyoming Pocket Gopher Habitat

The Stateline wind project in eastern Washington and Oregon was moved to avoid habitat for the Washington ground squirrel, which was on the state endangered species list (NWCC 2002). The Wyoming pocket gopher is similar in its rarity and unknown compatibility with wind power projects. Keinath and Beauvais (2006) point out that soil compaction and habitat fragmentation associated with oil and gas development are a principal threat, stating, "A more likely threat is soil disturbance and compaction due to increased petroleum exploration and extraction. In this context, increased road density that accompanies petroleum development may be more of a threat than the construction of well pads and pipelines, since it would fragment habitat, which could impede population persistence." These researchers further recommend that "compaction of soils, in areas of known occupation will be detrimental to gophers and should be avoided;" that roads should not be permitted to bisect occupied areas; and that man-made raptor perches such as power poles, tanks, and fence poles should not be located near occupied habitat. Due to the rarity of the Wyoming pocket gopher and its sensitivity to habitat fragmentation and soil compaction, ground surveys should be conducted for projects in potential habitat for this species, and wind power plans should be adjusted to avoid occupied habitats.

Avoiding Mountain Plover Habitats

Occupied mountain plover nesting habitats should be avoided for the purposes of wind tower and powerline siting. For the purposes of this report, identified mountain plover nest concentration areas are identified as red "no go" zones for wind power development, and in other areas of potential plover nesting habitat, nesting season surveys should be undertaken and siting adjustments made to leave nesting areas undisturbed.

Protecting Prairie Dog Colonies and Black-Footed Ferrets from Overhead Powerlines

Because prairie dogs are particularly vulnerable to an increase in raptor predation when overhead powerlines are sited across or near colonies, powerlines should be buried within ½ mile of active prairie dog towns. Prairie dog colonies are marked on the map in yellow, indicating this caution regarding powerlines (without implying siting requirements for wind turbines themselves). Similar measures should apply to the Black-footed Ferret Recovery Area in the Shirley Basin, because depression of prairie dog populations through increased predation is a threat to this ferret population, perhaps the healthiest and most secure black-footed ferret population in America.

Minimizing Fragmentation in Forests and Bird Habitat Conservation Areas

Because bird habitats in both shrub steppe and woodland settings are vulnerable to fragmentation and because migratory birds are vulnerable to turbine-strike mortality, the Joint Ventures Bird Habitat Conservation Areas have been delineated on the map in yellow, indicating that caution should be exercised when siting utility-scale turbine arrays. Such arrays should be small and compact, and sited away from key bird habitats within these zones. For woodland areas (identified in yellow on the bat conservation map), wind power facilities should be sited in areas already heavily fragmented, and should avoid areas of continuous mature forest or connecting corridors that provide linkages for interior forest wildlife.

Overhead powerlines like these in the Thunder Basin National Grassland, with perching golden eagle (left) and near the town of Medicine Bow (below) pose problems for small mammals and sage grouse because raptors use them for perches. BCA photos.

Aesthetic Values and the Human Element

Bisbee (2005) remarked that "Popular visual aesthetic preferences are the primary obstacle to obtaining the emission reductions and other benefits wind power offers." Historically, concerns about visual impacts, particularly in the vicinity of towns, have sparked high levels of concern. According to Gipe (2005),

> "Opinion surveys show that wind has high public support, but a worrisome NIMBY ["Not In My Back Yard"] factor. This support erodes once specific projects are proposed. Because support is fragile and can be squandered by ill-conceived projects, the industry must do everything it can to insure that wind turbines and wind power plants become good neighbors. One means for maximizing acceptance is to incorporate aesthetic guidelines into the design of wind turbines and wind power plants."

San Gorgonio wind power facility. Photo © Michael J. Slezak.

According to Cownover (2007), "The size, number, scale, motion and visual prominence of wind turbines makes visual mitigation nearly impossible and communities are faced with challenges in embracing green technology while protecting landscape views they value." In a Riverside County (California) survey regarding the San Gorgonio wind facility, most residents were ambivalent about whether wind energy development was worth the aesthetic cost, while the remainder were evenly split between supporters and opponents of the wind facility (Gipe 2005).

It is critically important for the proponents to implement this project in a way that engenders local support rather than backlash, both to ease acceptance of this project and to ensure that future wind projects do not engender immediate resistance due to a controversial process in Rawlins. According to Pasqualetti (2000:392),

> "If developers are to cultivate the promise of wind power, they should not intrude on favored (or even conspicuous) landscapes, regardless of the technical temptations these spots may offer. Had this been an accepted admonition twenty years ago, the potential of the San Gorgonio Pass might have carried with it the threat of public backlash sufficient to cause more far-sighted developers to hesitate. This argues for a more careful melding of land use, scenic values, public opinion, and environmental regulations with the technical considerations of each site."

Pasqualetti added, "Such spatial realities, even if amplified by only a few vocal objectors, can rob momentum and dull enthusiasm for renewable energy." With this in mind, Anschutz may want to consider scaling back wind power development so that it is neither dense nor obtrusive within the viewshed of Rawlins, and/or phase the construction of the windfarms so that viewshed areas are impacted last.

In New York state, the Town of Warren (2006) established lands within 5 miles and lands within 8 miles of turbine sighting as the area of visual impact analysis. Sterzinger et al. (2003) also used a 5-mile viewshed radius, while the National Research Council (2007) recommended a 10-mile radius for examining viewshed impacts of wind projects and a 15-mile viewshed analysis for particularly important overlooks.

Sterzinger et al. (2003) determined that while it is commonly assumed that wind power development will lower property values for neighboring residents, the empirical evidence shows no reduction in property values for wind energy zones versus areas unaffected by wind development. Hoen (2006) found no property value impacts of wind energy facility construction at a small town in upstate New York, and argued that property values are an independent index of aesthetic quality.

The scale of the project, particularly if that scale is highly visible, is a critical aesthetic factor. National Research Council (2007:105) admonished, "A project that dominates views throughout a region is more likely to have aesthetic impacts judged unacceptable than one that permits other scenic or natural views to remain unimpaired throughout the region." The Danish wind power program has gained broad acceptance, in part because it is based on a number of small (1 to 30 turbine) projects (id.). The National Wind Coordinating Council (2002: 28) admonished, "Fewer and wider-spaced turbines may present a more pleasing appearance than tightly-packed arrays."

Among the recommendations of Gipe (2005) are maintaining aesthetic uniformity within an array (utilizing the same number of blades, similar turbine shapes), avoiding dense turbine spacing, and using low-contrast paint schemes to make the turbines less obtrusive. According to Pasqualetti (2000:391),

> "industry must strive to intelligently and carefully integrate turbines within individual landscapes in which they work.

Several generic steps can be taken, including attention to scale, symmetry of design, careful road construction and site preparation, and equipment maintenance."

The impacts of the proposed project on open space, which is valued by the public in its own right, need to be considered in any wind power development project. According to Pasqualetti (2000:390), "Open space remains the West's greatest attribute and attraction, the inalienable right of all those with the luck to have been born there or—as some believe—the sense to have moved there." Visibility of wind turbines increased annoyance levels in survey respondents (van den Berg et al. 2008). Perception is reality where aesthetic impacts are concerned, and in cases where the local perception is that the project will be a sustainable economic benefit to the community without the downside of being perceived as an eyesore. Interestingly, even large wind power projects such as those in northeastern Colorado can be noncontroversial when they are sited in remote areas lacking special landscapes and are distant from highways.

The National Research Council (2007:102) has outlined a process for evaluating the conditions under which the aesthetic impacts of a proposed wind project might become unacceptable or "undue" in regulatory terms, considering the following factors:

- Has the applicant provided sufficient information with which to make a decision? These would include detailed information about the visibility of the proposed project and simulations (photomontages) from sensitive viewing areas. ...
- Are scenic resources of local, statewide or national significance located on or near the project site? Is the surrounding landscape unique in any way? What landscape characteristics are important to the experience and visual integrity of these scenic features?
- Would these scenic resources be significantly degraded by the construction of the proposed project?
- Would the scale of the project interfere with the general enjoyment of scenic landscape features throughout the region? Would the project appear as a dominant feature throughout the region or study area?
- Has the applicant employed reasonable mitigation measures in the overall design and layout of the proposed project so that it fits reasonably well into the character of the area?
- Would the project violate a clear, written community standard intended to protect the scenic or natural beauty of the area? Such standards can be developed at the community, county, region, or state level.

Project proponents who can answer these questions to the satisfaction of local residents will not only be better able to clear regulatory hurdles but also will be better able to gain local support for wind power projects. In addition, wind energy producers who provide electricity free or at reduced rates to local communities might experience less opposition and controversy surrounding wind projects on locations visible from town.

***At Right:** A register rock carved with the names of pioneers along the Overland Trail in the Red Desert. BCA photo.*

Historical and Cultural Resources

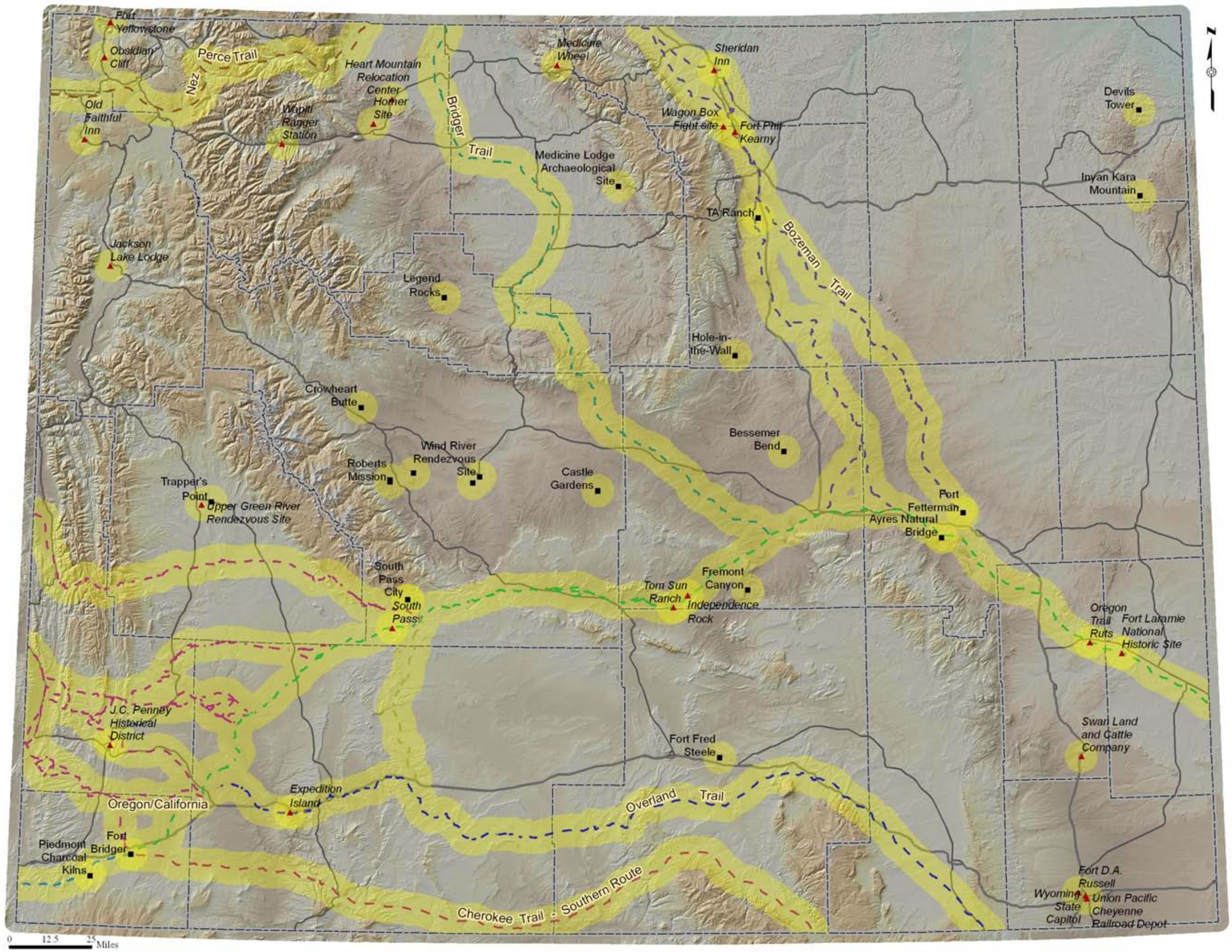
The National Historic Preservation Act's regulations state that an "adverse effect" to hisotric properties results from the "[p]hysical destruction of or damage to all or part of the Property," "[a]lteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines" or the "[c]hange of the character of the property's use or of physical features within the property's setting that contribute to its historic significance." 36 C.F.R. § 800.5(a)(2)(i-ii, iv). Wind power facilities can cause significant impacts to the settings of historical and cultural sites listed on or eligible for the National Register of Historic Places. Wind facilities are seen by the viewer as symbols of technological development (Gipe 2005), and thus are in-

Map Legend

- NPS National Historic Landmarks
- 5-mile viewshed buffer
- Other important historic sites
- Historic Trails

Historic Sites and Trails

5-mile viewshed buffers shown



Stable ruins, Point of Rocks Stage Station along the Overland Trail. BCA photo.

compatible with historic settings. It would be very difficult to minimize or mitigate the impacts of a wind power array on the setting of a historic property. The best way to avoid this thorny issue is to site wind facilities in such a way that intervening topography masks them from view from historic trails and sites.

Visual Resources Management

In its long-term land-use plans, the Bureau of Land Management typically outlines areas where maintaining visual resources is a management priority. In Wyoming, wind power development would be precluded by regulation in Visual Resource Management Class I areas, "preserve the existing character of the landscape," and in any case all areas in this class are Wilderness Study Areas which must be managed to maintain their wilderness qualities. It would be very difficult for a utility-scale wind project to meet the requirements of Visual Resource Management Class II as well. These requirements state:

> The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

BLM Manual H-8410-1. It is apparent that wind power facilities would not be able to meet these standards. These administrative requirements pose an additional constraint on wind power development.

Best Practices for Protecting Aesthetic, Historic Values

Getting Local Buy-In for Projects within 5 Miles of a Town

An open and inclusive public process benefits wind energy development by allowing public concerns to be addressed and gaining buy-in from neighboring communities. Hasty permitting projects with accelerated timelines result in trouble for wind power projects, according to the National Wind Coordinating Council (2002); this body pointed out that making enemies can result in lawsuits and ordinances that slow or prevent wind projects near communities. For lands within 5 miles of established towns, we recommend siting wind facilities in areas screened from view by intervening topography, and where this is not possible, getting formal buy-in from the local community via resolutions of approval from elected town bodies.

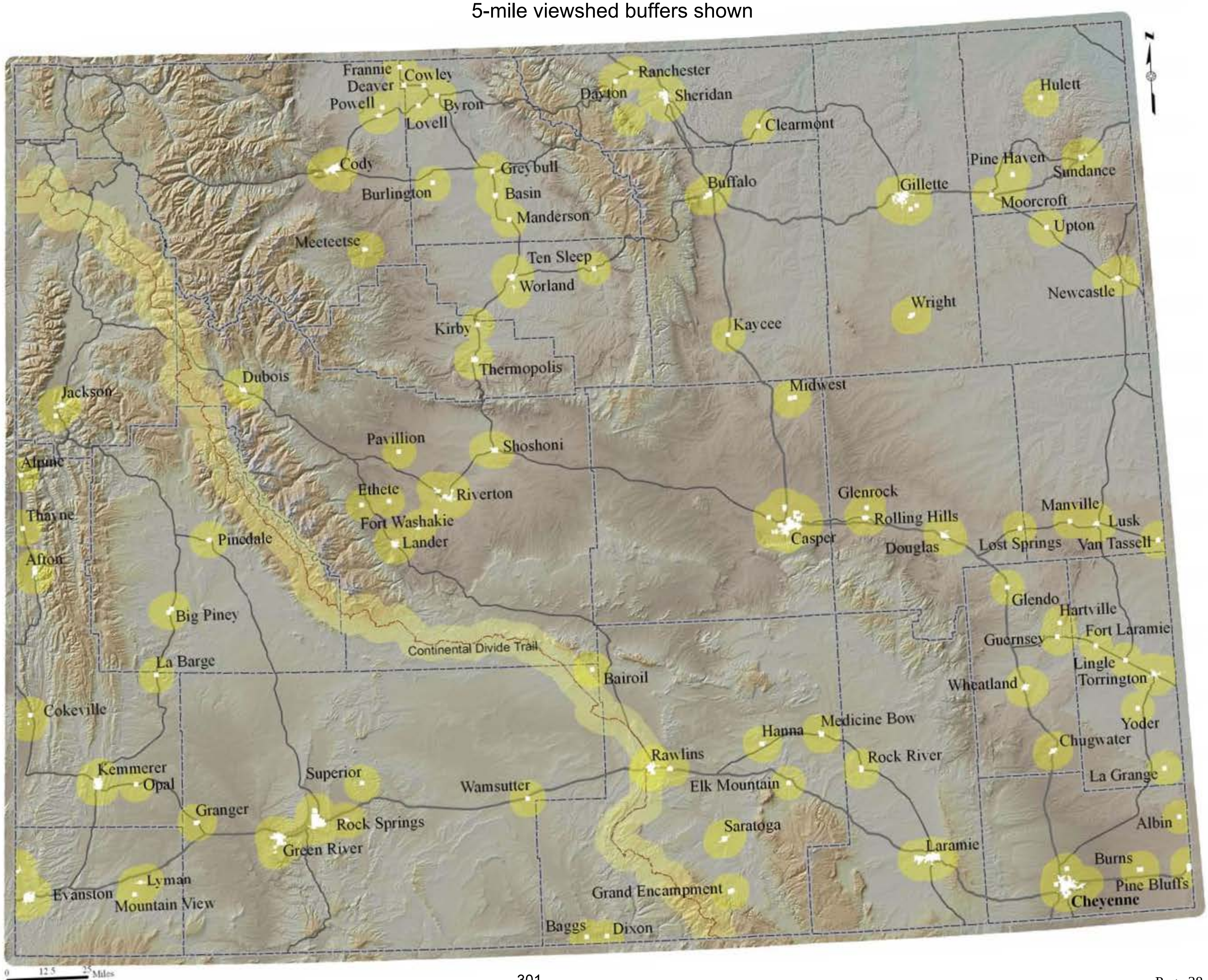
Minimizing the Impacts of Noise and Shadow Flicker near Dwellings

Impacts of turbine noise and shadow flicker should also be considered, particularly in cases where residents live very close to the proposed turbine array. Turbine noise is generally a factor only within 0.5 mile of the turbine site (National Research Council 2007). In a Netherlands study, van den Berg et al. (2008) found that when noise increased from 30 dBA to 45 dBA, respondents showed increased annoyance. Noise and shadow flicker have been identified as issues in Europe (National Research Council 2007), and shadow flicker has been recognized as a distraction to drivers and a potential safety hazard in some countries (MSU 2004). For projects sited away from primary access roads and human dwellings, these impacts should be of minor concern.

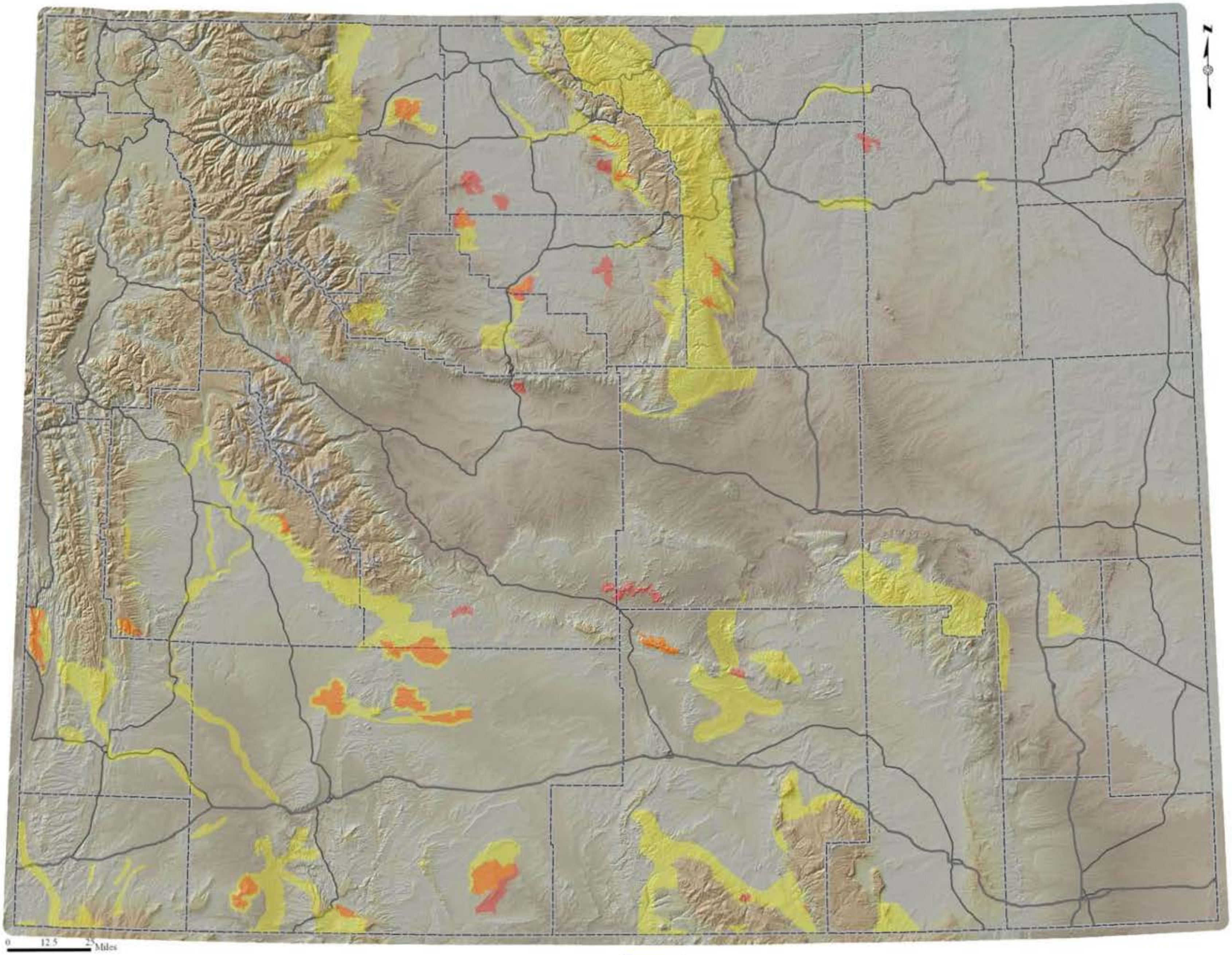
Wind turbines near Grover, Colorado. Erik Molvar photo

Municipalities and the Continental Divide Trail

5-mile viewshed buffers shown



BLM Visual Resource Management Classes



Visual Resource Management Class I

Visual Resource Management Class II

Shielding the Viewsheds of Historic Properties from Wind Turbines

Within 5 miles of important historic sites and trails, we recommend using great caution by siting wind power facilities only in areas that are visually screened from view from the historic property.

Consulting with Tribes on Traditional Cultural Properties

Wind energy companies should undertake formal consultation with Native American tribes to identify Traditional Cultural Properties, and these should be accorded a similar level of respect and protection as historic trails and sites.

At right: *Red Desert petroglyphs. BCA photo.*

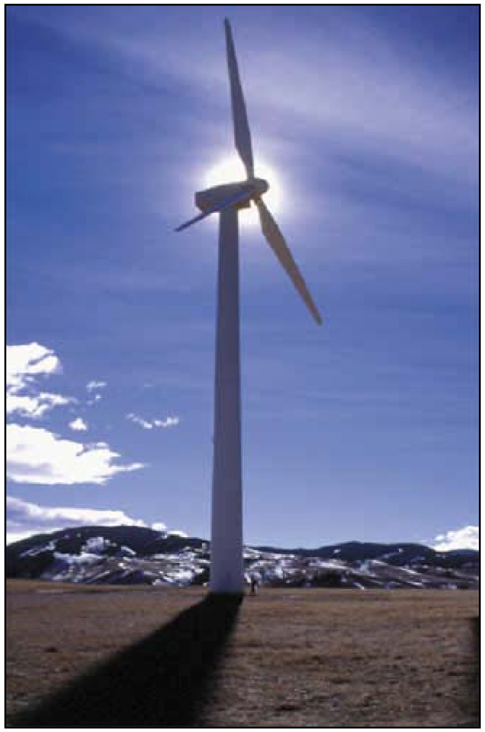
Below: *Transmission lines can also be an aesthetic issue. Erik Molvar photo*

*From a distance of 10 miles, Wyoming's Foote Creek Rim facility (**above**) is almost imperceptible. Wind power developments near Grover, Colorado (**below and below left**) are remote from towns and highways, and thus have not been controversial.*

Wind Power Potential and Siting Considerations

To date, the wind power potential of a site has been the principle (and often the only) consideration driving the siting of wind turbine arrays in Wyoming. While the velocity of wind and how consistently it blows are primary considerations, other factors also contribute to a site's wind power potential. The density of the air interacts with velocity to determine the power output that can be harvested, so for wind farms operating at similar windspeeds, low elevation facilities yield greater power than high-elevation turbine arrays working in thinner air. In addition, areas with a smooth, laminar flow of wind will provide more efficient wind power generation than areas where the wind is gusty or turbulent; for this reason, areas with broken topography are often less preferred for wind power siting even if they experience strong, consistent winds. We recommend that in the future, wind power siting be selected on the basis of both wind power potential and environmental considerations, and that the areas with strong wind potential that are in areas with few or no environmental conflicts should be the first to be developed for utility-scale wind energy generation.

The accompanying map shown on page 43 displays the wind power potential of Wyoming on a coarse scale, as mapped by the National Renewable Energy Laboratory. The higher the numerical rating, the stronger the potential is estimated to be for wind energy generation. At present all areas showing a rating of Class 4 or higher are considered to have commercial wind power potential, but areas rated at Class 3 are expected to become commercially viable in the near future due to improvements in wind turbine efficiency.



The wind farm at Foote Creek Rim had low raptor fatality rates because it was sited away from nesting concentration areas. Bonneville Power Administration photo.

The Value of Siting Wind Power in Areas of Few Environmental Conflicts

When all of the sensitive wildlife habitats and high-value landscapes are factored in, Wyoming offers a great deal of wind power potential without building turbines in areas that entail heavy impacts or social conflicts. The map at right shows areas that should not be considered for wind power development in red, areas where wind power development could occur once resource concerns are successfully addressed in yellow, and areas with negligible resource concerns in green. Areas with multiple cautions are marked in yellow, indicating that several different sensitive resources are present, and while solutions may present themselves for resolving these concerns and siting wind turbines successfully, the process is likely to be more complex. We recommend prioritizing the green zones with high wind power potential as areas where utility-scale wind power generation should start, with yellow areas also meriting consideration as long as the Best Practices for the sensitive resources in question are followed. In addition, large extents of green zone are the best candidates for bringing in additional electrical transmission capacity to support the growth of the wind power industry.

Based on our recommendations, about half of the state would be suitable for wind power development under varying levels of caution, while the other half is recommended as exclusion areas (some of which are already off-limits to any kind of industrial development by law or regulation). Sage grouse habitats are the primary driver of recommended exclusions. Special landscape designations also contribute, while raptor nest concentration areas appear to be fairly easy to work around for the purposes of wind farm siting. A substantial amount of the state is outlined in yellow, indicating that wind power projects could proceed once resource concerns were addressed.

Green zones, lacking major conflicts identified in the report, are recommended as priority areas for wind energy development. The largest of these zones is in southeastern Wyoming east of the Laramie Range, on both the north and south sides of the Platter River valley. By happy coincidence, this area also has the largest extent of high wind potential in the state. Other areas with concentrations of green zone corresponding with strong wind power potential include parts of the High Plains northeast of Casper and the southern tail of the Big Horn Mountains. Green areas on the Wind River Indian Reservation and in the northern part of the Powder River Basin also merit consideration, but have lower wind power potential.

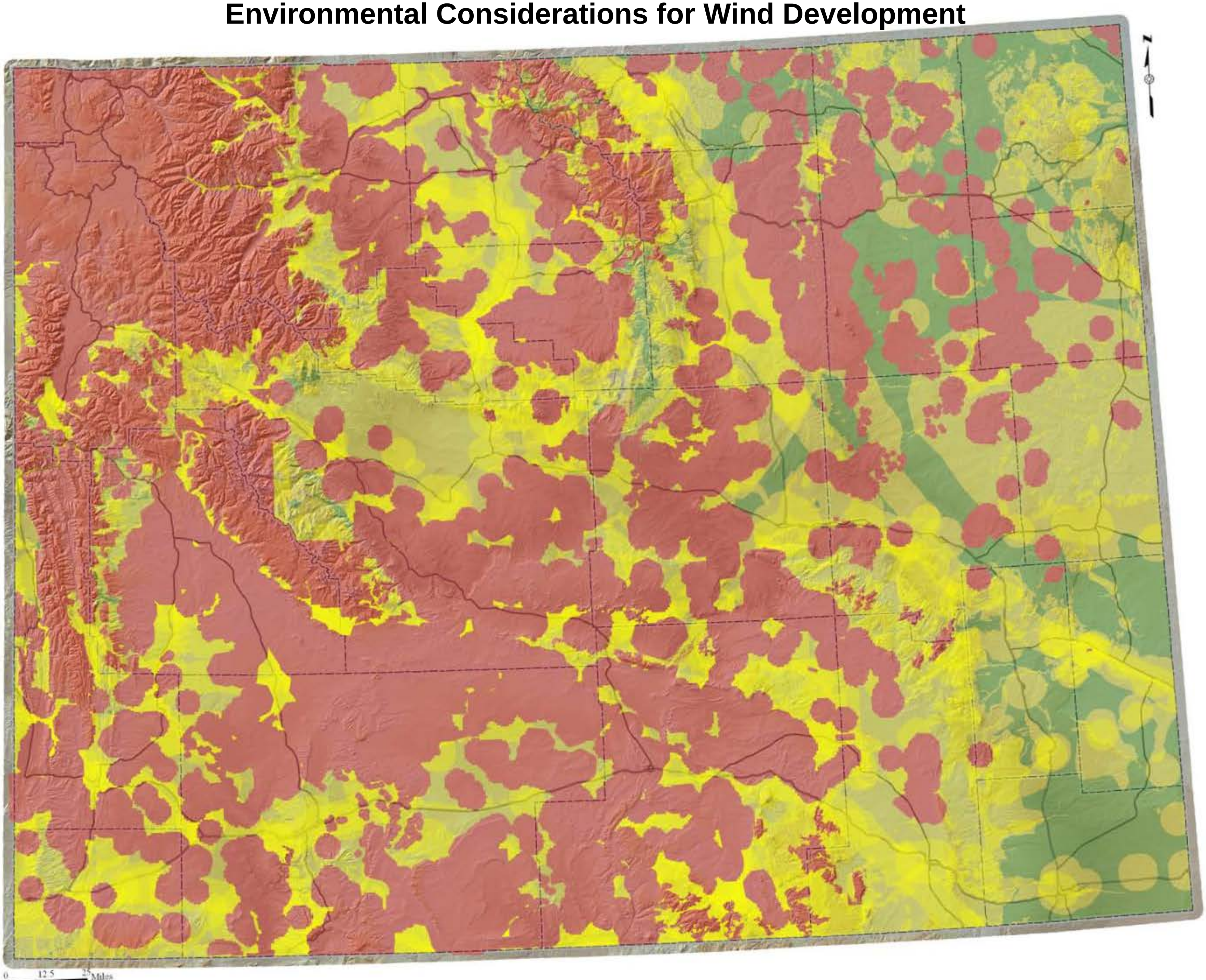
Adding Value by Siting Wind Energy in Impacted Areas

The first screens in determining where wind energy should be sited should be wind energy potential and avoidance of sensitive habitats and landscapes.

Map Legend

- Wind power exclusion area
- Wind power promotion area
- Wind power caution area - single resource concern
- Wind power caution area - multiple resource concerns

Environmental Considerations for Wind Development



Once this first screen has been analyzed, the impacts of wind energy development can be further reduced by siting turbine arrays on lands that have already been heavily impacted by another form of industrial use. Thus, if wind energy must be sited in an area where cautions are indicated, siting facilities in industrialized areas will reduce the chances of resource conflicts. And in the "green zones" where conflicts are already minimal, siting wind towers in areas that are already impacted helps to protect open space, which is a legitimate value even in areas where habitat values are low and aesthetic concerns are not preeminent.

Oil, Gas, and Coalbed Methane Fields

Oil and gas development causes habitat fragmentation on a massive scale as well as essentially eliminating the value of wildlife habitat for species sensitive to vehicle traffic and other types of human disturbance. In theory, conventional oil and gas fields are typically designed to have a life of 30 to 50 years, after which they would be fully reclaimed and wildlife would be able to return. In practice, the large companies who typically develop major fields often sell off their interests to smaller independents as production begins to decline, and these wells are often sold as "stripper wells" to holding companies and individuals who keep them running to one degree or another for many years past their projected lifespan. In Wyoming, there has never been a major oil and gas field that has ever been returned to a natural state, to become fully functioning wildlife habitat once again.

Nonetheless, adding a wind farm (which is a much longer-term development, perhaps permanent) to an oil and gas field forecloses the opportunity of final reclamation for energy development and assures that the area will remain developed even after the oil and gas runs out. With these considerations in mind, siting in oil and gas fields is a major asset only in cases where the sensitive wildlife are entirely gone, and the prospect for ultimate reclamation is remote. Coalbed methane fields typically run out of product within 10 to 20 years, and it is not useful to view them as long-term sacrifice zones for the purposes of wind farm siting, even though their habitat value may be essentially zero during the life of coalbed methane production operations.

Reclaimed Mine Sites and Landfills

Landfills and reclaimed strip mines offer potential sites for wind power facilities that have less to lose from a habitat standpoint than native habitats. Strip mines for coal and bentonite are present in various parts of the state, and surface facilities for trona mines and processing plants are present in southwest Wyoming and, due to the level of human activity, might be attractive areas for co-locating wind farms. Coal mines are required under federal law to reclaim strip mine areas; these reclamation efforts have enjoyed a variable level of success, with grasses much easier to re-establish than trees and shrubs. As a result, reclaimed coal mine lands are likely to return to some level of habitat function, but are often not as productive for native wildlife as undisturbed lands. Landfill areas are in a similar situation but receive lower reclamation effort, and wind power facilities may be sited in landfill areas even while they are actively in use

Wind power facility in the dry-land crop fields in eastern Oregon, a compatible use that reduces environmental conflicts. Scott Smith photo.

(unlike open pit mine sites, where blasting activity would typically preclude the siting of wind turbines until after reclamation is underway). While there have been instances where reclaimed mine sites in high bat use areas have had wind farms that experienced very high levels of bat mortality (see, e.g., Fiedler 2004), reclaimed surface mines, mine-related facilities, and landfills make attractive candidates for wind power siting due to their lower habitat value.

Agricultural Lands

Wind energy is compatible with farming and livestock grazing (Elliott and Schwartz 1993), and the National Wind Coordinating Council (2002: 23) considers agriculture as "a wind-compatible resource." Because wind developments typically take less that 2% of the land out of agricultural production and yield additional sources of revenue, they may be especially attractive to private agricultural landowners (Gordon 2004). In a Netherlands study, van den Berg (2008) found that respondents with direct economic benefits were more accepting of wind turbines from visual and noise perspectives. This suggests that siting

Map Legend

Existing transmission line, undifferentiated

Class 2 - Wind Power-Density 200-300 W/m^2 at 150 m height

Class 3 - Wind Power-Density 300-400 W/m^2 at 150 m height

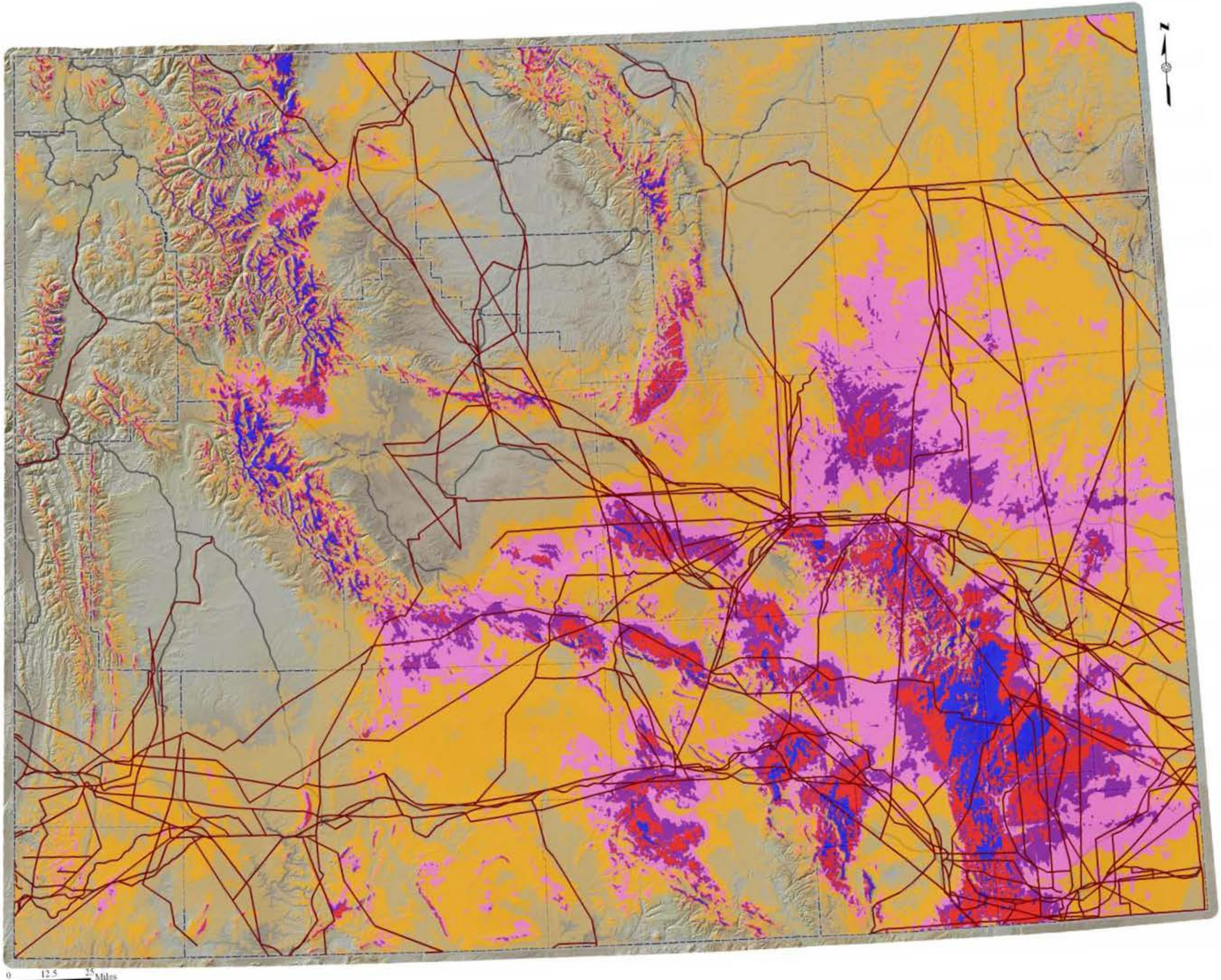
Class 4 - Wind Power-Density 400-500 W/m^2 at 150 m height

Class 5 - Wind Power-Density 500-600 W/m^2 at 150 m height

Class 6 - Wind Power-Density 600-800 W/m^2 at 150 m height

Class 7 - Wind Power-Density > 800 W/m^2 at 150 m height

Wind Power Potential and Electrical Transmission



turbines on private lands may entail greater acceptance as landowners realize direct benefits while the public does not perceive direct compensation for the development of utility-scale wind projects on public lands. Thayer (2007) asserted, "Wind energy development on scenic public lands is less appropriate than wind farming on private rangeland because wind power provides more of a boost for productive farm/ranch management with less controversy over resource/aesthetic controls."

In particular, crop fields support a monoculture of non-native vegetation tend to provide ecologically impoverished fauna and low biodiversity. This is particularly true of dry-land farming of the type used in southeastern Wyoming and the Bighorn Basin. Leddy et al. (1999) recommended siting wind turbines in crop fields, which already have reduced densities of grassland birds. In general, bird fatalities at sites located in agricultural croplands have been at the lower end of the spectrum. At the Nine Canyon site, built in wheatfields and grazing lands of central Washington, Erickson et al. (2003) estimated 3.59 bird fatalities per turbine per year and 3.21 bat fatalities per turbine per year, for a total of 133 birds and 119 bats per year for the entire facility. We recommend crop fields as priority areas for wind turbine siting in the context of

Private grazing lands typically retain a much greater native habitat value and should not be considered sacrifice zones for the purposes of priority wind farm siting. Leddy et al. (1999) observed that the siting of wind turbines on Conservation Reserve Program lands may cancel out the habitat value of these lands for songbirds. However, feed lots would definitely qualify as areas where wind turbine siting would add minimal additional impact and could be priority sites for wind development.

General Best Management Practices

Transmission Lines

Wind power development is also more economical when sited close to existing transmission lines, particularly for smaller projects. Larger wind projects may generate sufficient electricity to require (and justify) long spur lines of their own. In Wyoming, most long-distance transmission lines are already heavily committed to coal-fired generation, leaving little capacity to carry wind power to distant markets. Transmission lines are shown on the accompanying map, but the current GIS data lacks the detail to discriminate the capacity of each line, so it is impossible to tell large-capacity power lines from smaller ones. Thus, the construction of major new electrical transmission lines will be necessary to accommodate any major increase in wind power development. Major new transmission projects sited in areas of high wind power potential are likely to stimulate the construction of new wind power projects nearby (a sort of "if you build it, they will come" effect). With this in mind, we encourage the construction of major new lines dedicated to wind power transmission into areas of low wildlife and cultural sensitivity, and avoiding the siting of major new lines through zones where wind power development would cause major resource conflicts.

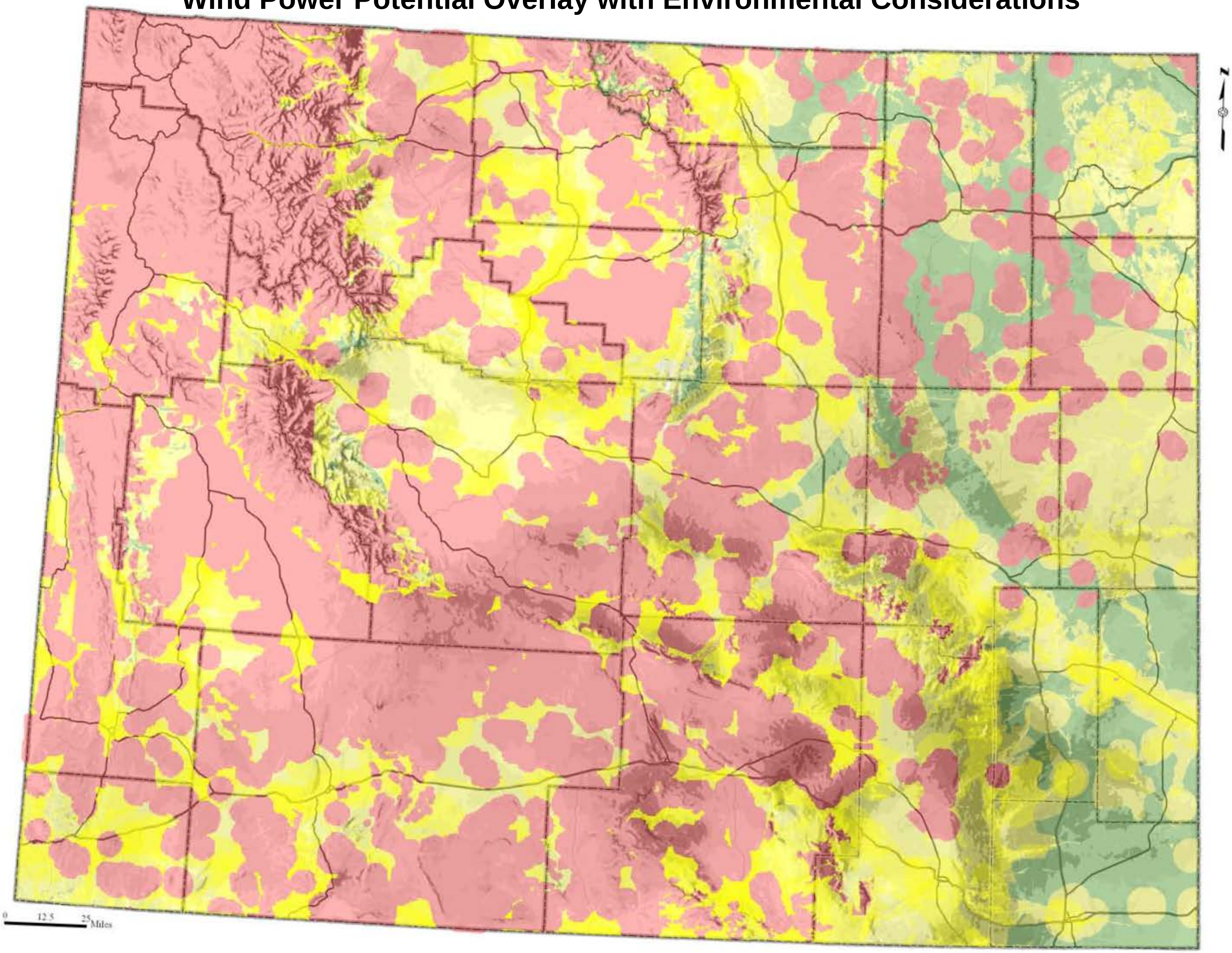
Transmission lines leading away from the Dave Johnson coal-fired power plant near Wheatland. Erik Molvar photo.

Powerline towers are likely to concentrate raptor nesting and perching activities, to the potential detriment of prey species. Transmission towers may be particularly attractive as nest sites for ravens, and Steenhof et al. (1993) reported that 133 pairs of ravens had colonized transmission towers on a single stretch of powerline in Idaho during its first 10 years of existence. Gilmer and Wiehe (1977) found that nest success for ferruginous hawks was slightly lower for transmission towers than other nest sites, and noted that high winds sometimes blew tower nests away. Steenhof et al. (1993) also found that transmission tower nests tended to be blown down, but found that nest success was not lower on

Map Legend

Class 2 - Wind Power-Density 200-300 W/m^2 at 150 m height	Class 7 - Wind Power-Density > 800 W/m^2 at 150 m height
Class 3 - Wind Power-Density 300-400 W/m^2 at 150 m height	Wind power exclusion area
Class 4 - Wind Power-Density 400-500 W/m^2 at 150 m height	Wind power caution area - single resource concern
Class 5 - Wind Power-Density 500-600 W/m^2 at 150 m height	Wind power caution area - multiple resource concerns
Class 6 - Wind Power-Density 600-800 W/m^2 at 150 m height	Wind power promotion area - lacking identified resource concerns

Wind Power Potential Overlay with Environmental Considerations



Acreage of Land by Wind Potential and Environmental Sensitivity

Wind Power-Density Class	Acreage in Green Zones (% of Power-Density Class)	Acreage in Yellow Zones (% of Power-Density Class)	Acreage in Green or Yellow Zones (% of Power-Density Class)	Acreage in Red Zones (% of Power-Density Class)	Total Acreage in Power-Density Class (% of Statewide Total)
Class 1	109,153 (0.70%)	4,987,687 (31.85%)	5,096,840 (32.55%)	10,561,059 (67.45%)	15,657,899 (25.13%)
Class 2	866,887 (5.77%)	6,044,410 (40.26%)	6,911,297 (46.03%)	8,101,934 (53.97%)	15,013,231 (24.09)
Class 3	1,843,786 (11.56%)	5,655,140 (35.45%)	7,498,926 (47.00%)	8,454,852 (53.00%)	15,953,778 (25.60%)
Class 4	1,322,415 (16.23%)	3,134,657 (38.48%)	4,457,072 (54.71%)	3,689,367 (45.29%)	8,146,439 (13.07%)
Class 5	524,054 (14.87%)	1,518,049 (43.08%)	2,042,103 (57.96%)	1,481,348 (42.04%)	3,523,451 (5.65%)
Class 6	199,024 (7.47%)	1,465,368 (55.04%)	1,664,392 (62.51%)	998,182 (37.49%)	2,662,574 (4.27%)
Class 7	61,407 (4.52%)	761,182 (55.97%)	822,589 (60.49%)	537,374 (39.51%)	1,359,963 (2.18%)
Totals (% of Statewide Acreage in Zone Class)	4,926,726 (7.91%)	23,566,493 (37.82%)	282,493,219 (45.72%)	33,824,116 (54.28%)	

towers for ferruginous hawks and was significantly higher on towers for golden eagles. In North Dakota, Gilmer and Stewart (1983) found that ferruginous hawk nest success was highest for powerline towers and lowest for nests in hardwood trees. Thus, although powerlines can be designed to minimize impacts to raptors, these corridors should be sited more than 2 miles away from prairie dog colonies and sage grouse leks to prevent major impacts to these sensitive prey species.

In order to encourage wind energy development, it would be helpful to build powerlines into areas of high wind potential and low environmental conflict to facilitate wind energy development. The siting of these powerlines should avoid sensitive areas outlined in this report. In particular, powerline corridors should be sited more than 1 mile away from prairie dog colonies and avoid sage grouse nesting and wintering habitats to prevent major impacts to these sensitive prey species. When avoidance is not feasible, burial of the powerlines provides an option that avoids most of the impacts inherent to overhead power lines.

Avoiding Impacts to Sensitive Soils

Depending upon siting, soil erosion could become a concern. According to the National Research Council (2007:49), "The construction and maintenance of wind-energy facilities alter ecosystem structure, through vegetation clearing, soil disruption and potential for erosion, and this is particularly problematic in areas that are difficult to reclaim, such as desert, shrub-steppe, and forested areas." We recommend siting wind turbine facilities and access routes away from steep (greater than 25 degrees) or unstable slopes or areas with high erosion potential.

Lower-Impact Access Routes

Improved gravel roads have been used in some cases for access to wind turbines in wind farm settings, while in other cases (particularly in croplands) jeep trails, or no access route at all, are the rule. In most cases, gravel access roads will not only be unnecessary but will also increase the level of project impacts (from dust pollution to wildlife disturbance). We recommend the use jeep trails or no access routes at all to individual turbine towers within a facility development. Vehicle traffic within the turbine array can be further minimized by siting control stations and other related facilities at the near edge of the development to minimize unnecessary vehicle traffic through the turbine arrays.

Conclusions

By following the recommendations in this report, decisionmakers and the wind industry can minimize conflicts with sensitive resources and minimize the potential for controversy. In this way, Wyoming wind energy can enjoy the broadest popular support possible, making approvals for future projects faster and easier. Doing wind power "smart from the start" provides immediate and obvious benefits by protecting sensitive wildlife and key landscapes, but also benefits the wind industry by streamlining clean wind energy projects.

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Data Sources for Maps

Map	Coverage or Shapefile	Description	Data Source
Special Designations	WY_ACECs.shp	Designated BLM ACECs	BLM
	nca_north.shp	Proposed Red Desert NCA, north units	BCA
	nca_south.shp	Proposed Red Desert NCA, south units	BCA
	Proposed_Acec.shp	Proposed ACECs, Rawlins BLM Field Office	BCA
	wcwp_nad83.shp	Citizens' proposed wilderness areas	BCA
	kr_north.bnd	Kinney Rim North citizens' proposed wilderness	BCA
	kr_south.bnd	Kinney Rim South citizens' proposed wilderness	BCA
	flaming_gorge.shp	Flaming Gorge National Recreation Area	USFS
	Roadless_Areas.shp	Inventoried Roadless Areas	USFS
	nps.boundary.shp	National Park and Monument units	NPS
	wilderness_areas.shp	Congressionally designated wilderness	USFS
	McCulloughFinal.shp	McCullough Peaks citizens' proposed wilderness	BCA
	SouthForkPowder3.shp	S. Fork of the Powder citizens' proposed wilderness	BCA
	skde.shp	Seedskadee Natl. Wildlife Refuge	USFWS
	special_desg.shp	Designated Wild and Scenic Rivers	USFS
Ecoregional Conservation Plans	conservation_opportunities.shp	Northern Plains Conservation Network Core Areas	WWF
	Heart of the West coverage files	Heart of West Conservation Plan Cores/Linkages	WUP
Birds of Prey	WFORaptors.shp	Raptor nest sites, Worland Field Office	BLM
	RSFOraptor_points.shp	Raptor nest sites, Rock Springs F.O.	BLM
	RFORaptors.shp	Raptor nest sites, Rawlins F.O.	BLM
	PFORaptor.shp	Raptor nest sites, Pinedale F.O.	BLM
	LFORaptors_1283.shp	Raptor nest sites, Lander F.O.	BLM
	KFO_raptor_nests_july04.shp	Raptor nest sites, Kemmerer F.O.	BLM
	CYFObald eagle roosting areas 1 mile buffer.shp	Bald eagle roosts, Cody F.O.	BLM
	CFORaptors.shp	Raptor nest sites, Casper F.O.	BLM
	BFOgdbRaptor.mdb	Raptor nest sites, Buffalo F.O.	BLM
	CYFO raptor coverage files	Raptor nest sites, Cody Field Office	BLM
Bat Habitat	Northwest ReGap Zones 21, 22, 29	Woodland cover types as potential bat habitat	NW ReGAP

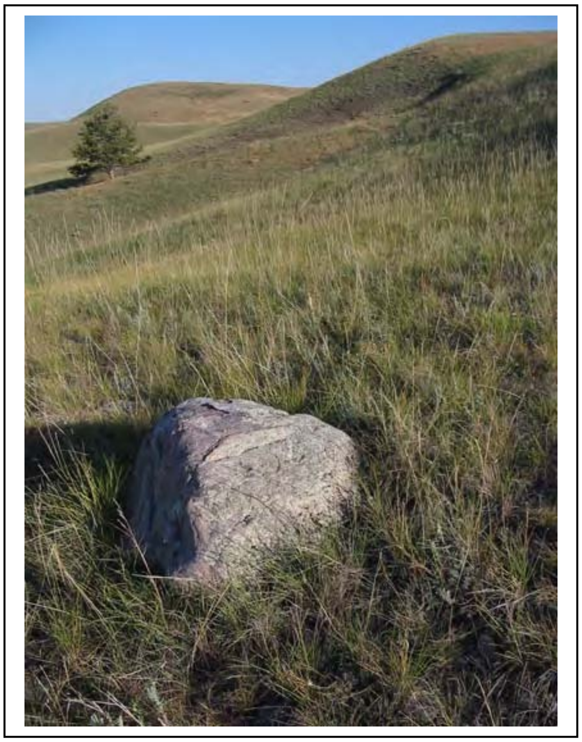
Map	Coverage or Shapefile	Description	Data Source
Sage Grouse and Sharp-Tailed Grouse	co_sagegrouse_wyndd.shp	Columbian sharp-tailed grouse lek sites	WYNDD
	Sharptail_Grouse_Lek_points.shp	Plains sharp-tailed grouse leks	BLM
	65perctbreak.shp	Sage grouse leks w/65% of state population	WGFD
	70perctbreak.shp	Addl. sage grouse leks for 70% of state population	WGFD
	75perctbreak.shp	Addl. sage grouse leks for 75% of state population	WGFD
	80perctbreak.shp	Addl. sage grouse leks for 80% of state population	WGFD
	85perctbreak.shp	Addl. sage grouse leks for 85% of state population	WGFD
	100perctbreak.shp	Addl. sage grouse leks for 100% of state population	WGFD
Antelope Crucial Ranges and Migration Corridors	ant08mr.shp	Pronghorn migration routes	WGFD
	ant99pa	Pronghorn parturition areas	WGFD
	ant06sr.shp	Pronghorn crucial winter and seasonal ranges	WGFD
Elk Crucial Ranges and Migration Corridors	elk05sr.shp	Elk crucial winter and seasonal ranges	WGFD
	elk05pa.shp	Elk parturition areas	WGFD
	elk08mr.shp	Elk migration routes	WGFD
Mule Deer Crucial Ranges and Migration Corridors	mdr06sr.shp	Mule deer crucial winter and seasonal ranges	WGFD
	mdr04pa.shp	Mule deer parturition areas	WGFD
	mdr08mr.shp	Mule deer migration routes	WGFD
Bighorn Sheep Crucial Ranges and Migration Corridors	bhs06sr.shp	Bighorn sheep seasonal and crucial winter ranges	WGFD
	bhs02pa.shp	Bighorn sheep parturition areas	WGFD
	bhs08mr.shp	Bighorn sheep migration routes	WGFD
Other Big Game Crucial Ranges and Migration Corridors	moo06mr.shp	Moose migration routes	WGFD
	moo04pa.shp	Moose parturition areas	WGFD
	moo05sr.shp	Moose seasonal ranges and crucial winter ranges	WGFD
	rmg99pa	Mountain goat parturition areas	WGFD
	rmg99sr	Mountain goat seasonal and crucial winter ranges	WGFD
Sensitive Wildlife Habitats	bffma.shp	Black-footed ferret recovery area	WGFD
	Plover_Acec.shp	Mountain plover nesting concentration areas	BCA
	WY_pdogcombinedgeo83.shp	Occupied prairie dog colonies	WGFD
	WY_BHCAs.shp	Joint Venture Bird Habitat Conservation Areas	ABC
	Northwest ReGap Zones 22, 29	Active and stabilized dunes	NW ReGAP

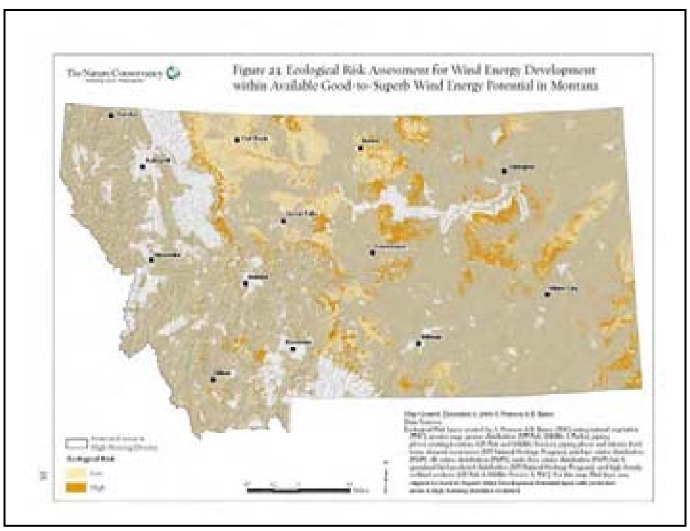
Map	Coverage or Shapefile	Description	Data Source
Historic Sites and Trails	hist_sites_natnl.shp	NPS National Historic Landmarks	BCA
	hist_sites_other.shp	Other historic Sites, Alliance Historic Wyoming	BCA
	pioneer_trails.shp	Historic trails	BLM
Municipalities and the Continental Divide Trail	CDNST_WY_Roads.shp	Continental Divide Trail road segments	CDTA
	CDNST_WY_Trail.shp	Continental Divide Trail trail segments	CDTA
	Municipalities.shp	Boundaries of Wyoming municipalities	WYGISC
	Counties.shp	County boundaries	WYGISC
	Roads100k.shp	TIGER roads and highways	WYGISC
BLM Visual Resource Management Classes	WYVRMClass2.shp	BLM designated VRM Class 2 lands	BLM
	WYWildernessStudyAreas.shp	BLM designated WSAs	BLM
Wind Power Potential And Electrical Transmission	powerlines_WUS_CAN_sgca.shp	Electrical transmission lines, undifferentiated	USGS
	PNW_50mwindouma.shp	Wind power potential, power-density at 50m	NREL

Data Source Definitions

ABC - American Bird Conservancy, Kalispell, MT
BCA - Data digitized by Biodiversity Conservation Alliance, Laramie, WY
BLM - Bureau of Land Management, U.S. Dept. Of Interior, Wyoming State Office, Cheyenne, WY
CDTA - Continental Divide Trail Association, Pine, CO
NREL - National Renewable Energy Lab, Golden, CO
NPS - National Park Service, Denver, CO
NW ReGAP - Northwest ReGAP Project, U.S. Geological Survey, Moscow, ID
USFS - USDA Forest Service
USFWS - U.S. Fish and Wildlife Service
USGS - U.S. Geological Survey
WGFD - Wyoming Game and Fish Department, Cheyenne, WY
WUP - Wild Utah Project
WYGISC - Wyoming GIS Science Center, University of Wyoming
WYNDD - Wyoming Natural Diversity Database

An Ecological Risk Assessment of Wind Energy Development in Montana





Brian Martin, Amy Pearson, Brad Bauer
The Nature Conservancy
Helena, Montana
January 2009

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ACKNOWLEDGEMENTS

We would like to thank many persons that provided input to this project. We would also like to thank persons that reviewed this document and provided valuable comments. Finally, we would like to thank the Priscilla Bullitt Collins Trust Northwest Conservation Fund for providing funding for this project.

EXECUTIVE SUMMARY

In 2008, the United States led the world in wind-power generation, providing 35% of the nation's new electrical generating capacity via wind power facilities. Montana ranks fifth among states for wind energy potential. While only two large-scale wind-energy facilities currently exist within the state, numerous others are planned, and several pending projects stand to vastly increase electrical transmission out of state, which will spark additional development.

Wind facilities are not stand-alone features—they cover vastly more area than the footprint of the turbines, requiring extensive road systems and transmission corridors. Significantly increasing wind-energy production will require millions of acres to accommodate development. The challenge for wind energy development in Montana is to produce relatively clean energy that does not contribute to global climate change, while minimizing impacts to wildlife and cultural and aesthetic resources.

Wind-energy development has progressed with very little science-based policy analysis to examine costs of biodiversity impacts, or for that matter, state or local regulation applicable to similar development of this magnitude. Further, since wind-power projects are proposed individually, cumulative impacts at regional scales are left unaddressed. Proper siting of wind energy facilities is key to reducing potential impacts and conflict. Towards this end, we have completed an ecological risk assessment, using broad-scale habitat information, as well as fine-scale data for 30 wildlife species of concern, selecting for those that research suggests would be the most susceptible to the impacts from wind-energy development.

We estimate that in total about 17 million acres of available good-to-superb wind energy potential exists within Montana. We identified at least 7.7 million acres that have a high risk to ecological values if projects were developed in those areas. We strongly suggest that high risk areas be avoided as locations for wind energy development, rather than considering mitigation approaches, as the lands identified are often critical habitat for multiple species. We also recognize that our efforts are based on breeding and resident species, and we have not considered migratory bird and bat species. Future research and monitoring is required to build our understanding of critical migratory routes, and there is also a need to develop best management practices for operations that will limit significant mortalities.

Finally, we hope this publication will spark cooperative efforts between wind energy and conservation interests, so that the promise of renewable energy can be achieved without sacrificing Montana's cultural, aesthetic, or biological heritage. This report should be viewed as a first version that will be updated and improved through on-going research and data collection. The latest information on distribution (observations, species occurrences, predictive models, range maps) can be obtained from the Montana Natural Heritage Program.

INTRODUCTION

In 2008, the United States led the world in wind power generation with 116,000-MW of capacity, and its importance in supplying electrical power continues to grow, providing 35% of the nation's new electrical generating capacity (AWEA 2008, USDOE 2008). Concerns about conventional energy sources and related carbon emissions, public policies mandating power generation from renewable resources, and declining production costs of wind energy are spurring additional wind development. For these reasons and others, President Bush established a goal of 20% of U.S. energy production coming from wind by 2030. In order to meet that goal, the U.S. Department of Energy (USDOE) (2008) estimates that 290,000-MW of additional generation will be required.

Wind facilities are not stand-alone features—they cover vastly more area than the footprint of the turbines, requiring extensive road systems and transmission corridors. Wind turbines themselves must be spaced to allow for maximum capture of wind, necessitating dispersed placement of turbines. Meeting the country's 20% wind energy generation goal will likely require an additional 241,000-MW from land-based facilities, with the remaining being water-based wind farms (USDOE 2008). Estimated land area required for the land-based wind farms is approximately 12.3 million acres (USDOE 2008), or roughly an area the size of New Hampshire and Vermont combined. Additionally, wind energy development will require extensive transmission line construction. For example, Montana currently has relatively expansive areas with no significant transmission infrastructure and most of the existing transmission lines are at or near maximum capacity. To deliver wind energy out of state will require future construction of perhaps thousands of miles of new transmission lines.

Wind energy development has progressed with very little science-based policy analysis to examine costs of biodiversity impacts. Further, since wind power projects are proposed individually, cumulative impacts at regional scales are left unaddressed. Overall, few research projects have been completed that document the impact of wind farms for a wide diversity of birds and bats (Kunz et al. 2007, Stewart et al. 2007). Additionally, very little is known about impacts to other local endemic species. In terms of birds and bats, research and monitoring completed to date has documented wind farms impacting species by: 1) destruction and fragmentation of habitat from the extensive footprint of the facilities and infrastructure, 2) significant impacts for birds and bats through displacement caused by the structural intrusion of turbines and transmission lines, noise, and down wash of air generated by blades, and 3) direct avian and bat mortality (Kunz et al. 2007, Kuvlesky et al. 2007, Stewart et al. 2007). In the case of bats, direct mortality may be significant, especially among tree-roosting species (ranging from 15.3 to 41.1 bats per MW per year) (Kunz et al. 2007). Additionally, construction and roads have the potential to facilitate the spread of invasive plant species (Kuvlesky et al. 2007).

Aside from individual species losses, these mortalities may have broader significance to the American public. For instance, bats are both pollinators and insect eaters. Their relevance to American agriculture for both pest management and propagation of crops should not be overlooked. Bats are experiencing downward trends in population due to both disease and human-caused decreases in habitat value (Mickleburgh et al. 2002).

Therefore, cumulative effects from existing stresses on bats, when taken into account with potential effects from wind projects, may add to the decline or local extirpation of these economically advantageous species.

To counter better-known environmental impacts, some states, such as Washington, California, and Minnesota, have adopted a regulatory framework to review wind projects on an ad-hoc basis, whereas many states, such as Montana, lack any regulation and generally rely on wind energy producers to essentially regulate themselves. In the absence of formal review, the purpose of this report is to identify potential risk to a subset of species found in Montana. As has been proposed in Wyoming (Molvar 2008), we believe that it is essential that wind farms are properly sited to avoid adverse impacts to biodiversity. At this time, we lack much of the research required to adequately assess all of the impacts wind energy development may have. However, we compiled the best available spatial data for resident and breeding populations to begin an initial analysis of locations that would have lesser and greater risk for biodiversity in Montana (Appendix A). In contrast, we do not address potential impacts on migratory species; future planning will need to focus much more effort on documenting migratory corridors for siting purposes and minimizing impacts to migrating species.

MANAGING ECOLOGICAL RISK THROUGH WIND ENERGY SITING

The challenge of wind energy development in Montana is to produce relatively clean energy that does not contribute to global climate change, while minimizing impacts to biodiversity. Montana is home to extensive intact habitats, retaining much of the species and viewsheds first documented by European explorers. It contains some of the largest, intact grasslands remaining in North America and more mixed-grass prairie than any other state in the Great Plains. It also retains extensive examples of montane coniferous forest systems that today support the most complete carnivore assemblages in the lower 48 states. Compared to most of the West, it has some of the least developed intermountain valleys. It also is home to the nation’s longest free-flowing river and harbors high quality aquatic and riparian habitats across the state.

Montana ranks fifth among states for wind energy potential, with an estimated average wind power output of 116,000-MWs (Wind Today 2008). As of 2007, Montana had 146-MW of capacity and another 500-MW under construction, illustrating the vast gap between current and potential development. Wind energy potential is predominantly located east of the Continental Divide (Figure 1). For the purposes of this project, we conducted our analysis of likely locations for wind energy development using the National Renewable Energy Lab (NREL) wind power class 4 or higher, since those classes have the greatest potential of generating wind power with large turbines (Figure 2). Within those wind power classes, we excluded urban areas and public lands that prohibit wind energy development, such as national parks, wilderness areas, and wildlife refuges. We also excluded private lands under conservation easement or managed by a conservation organization from consideration (although some easements may not restrict wind development) (Figure 3).

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Figure 1. Wind Energy Potential in Montana

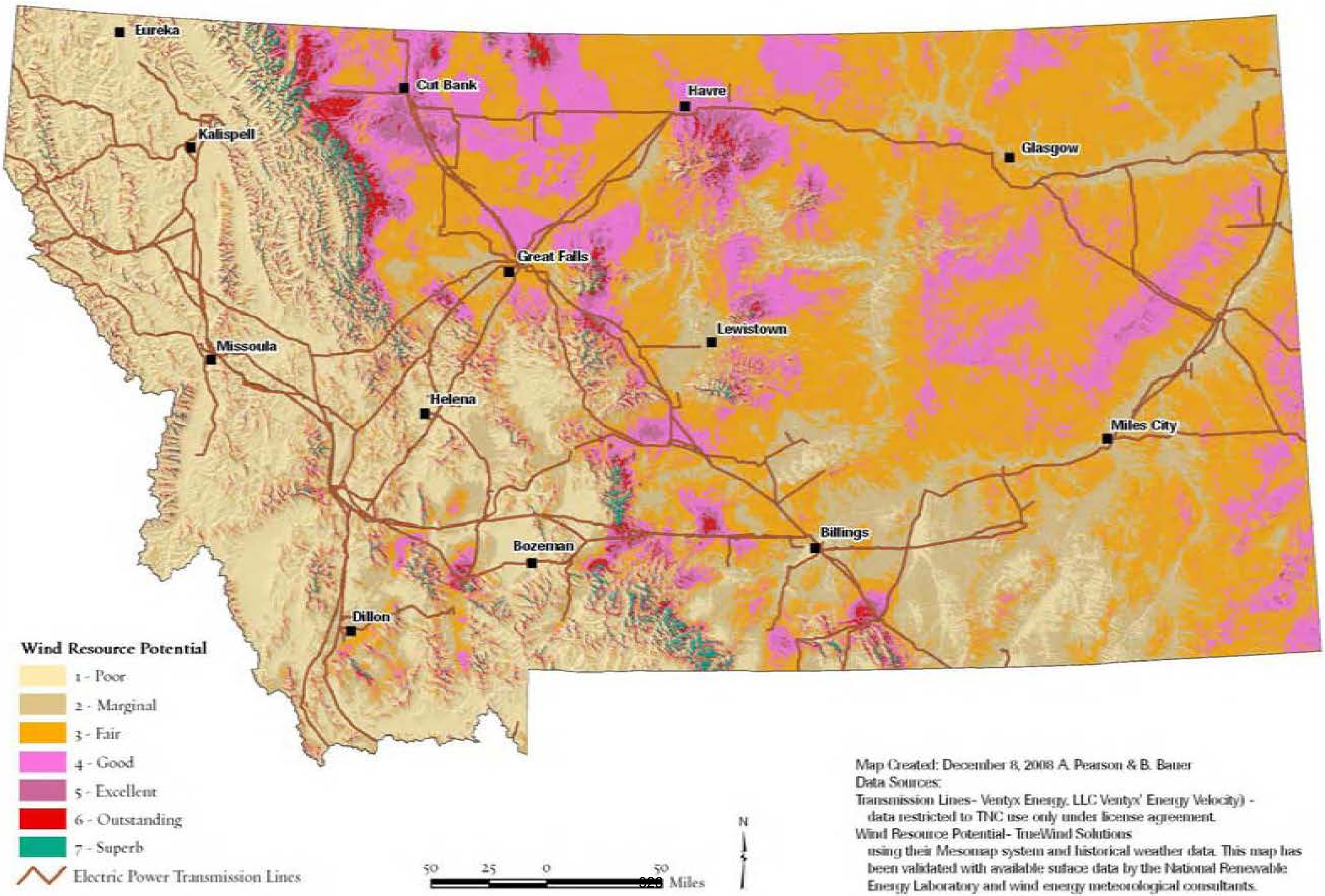

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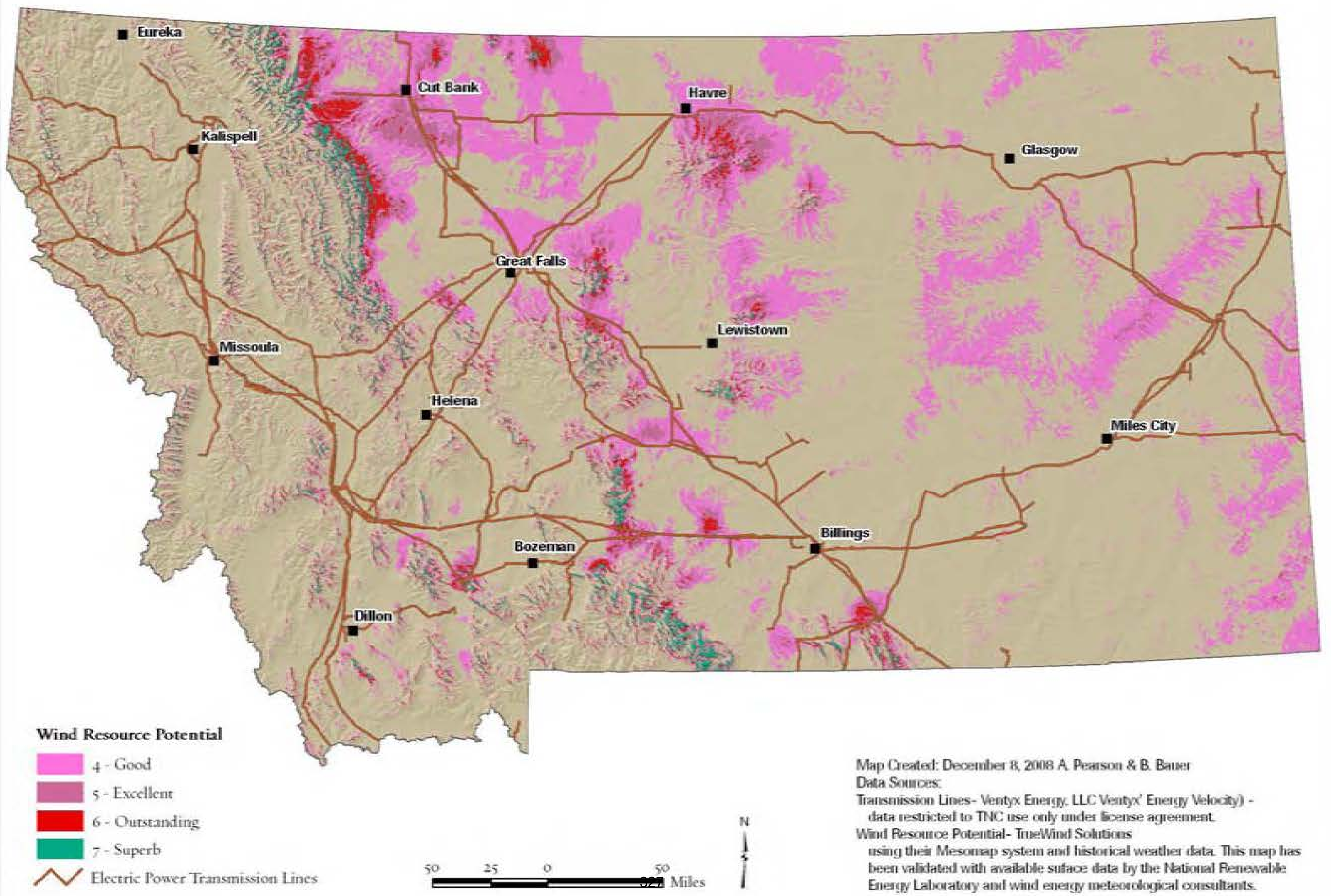
Figure 2. Good-to-Superb Wind Energy Potential in Montana



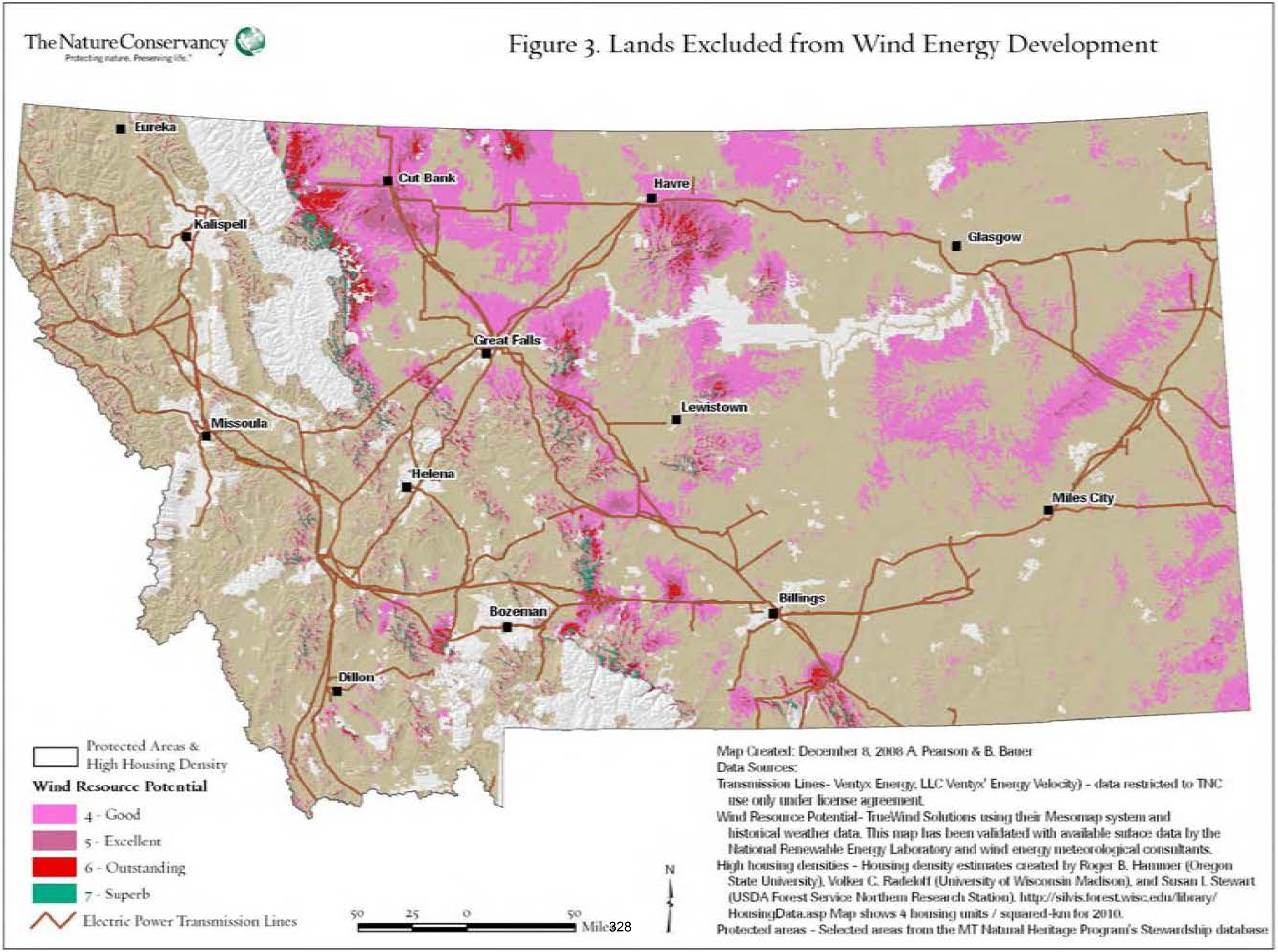

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Figure 3. Lands Excluded from Wind Energy Development
Eureka
Cut Bank
Havre
Kalispell
Glasgow
Great Falls
Lewistown
Missoula
Helena
Miles City
Billings
Bozeman
Dillon
Protected Areas & High Housing Density
Wind Resource Potential
4 - Good
5 - Excellent
6 - Outstanding
7 - Superb
Electric Power Transmission Lines
50 25 0 50
Miles
N
Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Transmission Lines- Ventyx Energy, LLC Ventyx' Energy Velocity) - data restricted to TNC use only under license agreement.
Wind Resource Potential- TrueWind Solutions using their Mesomap system and historical weather data. This map has been validated with available suface data by the National Renewable Energy Laboratory and wind energy meteorological consultants.
High housing densities - Housing density estimates created by Roger B. Hammer (Oregon State University), Volker C. Radeloff (University of Wisconsin Madison), and Susan I. Stewart (USDA Forest Service Northern Research Station). http://silvis.forest.wisc.edu/library/HousingData.asp Map shows 4 housing units / squared-km for 2010.
Protected areas - Selected areas from the MT Natural Heritage Program's Stewardship database

Low Risk Lands

We thought it was important to first identify those lands most conducive to wind energy development and have the lowest risk for resident and breeding wildlife. Extensively altered habitat, such as cropland, provide lower wildlife habitat values than intact habitats for resident or breeding birds, bats, and most other wildlife. This is also the case for most wide-ranging species of wildlife in lands already extensively fragmented by land use change (e.g., cropland) or through intensive industrial development activities, such as oil drilling and development. Therefore, wind energy development in cropland or highly fragmented habitats have intrinsically lower risk for conflict with many species of wildlife. We have identified approximately 4.4 million acres in Montana that have good or better wind energy potential and are relatively low risk (Figure 4). One caveat: these lands may retain importance as a portion of migratory flyways for birds and/or bats, and site-based management actions may still be required to reduce direct mortality.

SPECIES AT RISK FROM WIND DEVELOPMENT

This risk assessment for wind energy development impacts on biodiversity begins at the coarsest level of intact habitats that generally support a rich diversity of plant and animal species. As a coarse-scale assessment, we have utilized National Land Cover Classification to identify relatively intact habitats (Figure 5). From there we selected a subset of species to evaluate the risk of wind energy for biodiversity within Montana, recognizing that birds and bats are the most widely researched species, but that other species may be impacted. Species selected were also biased towards eastern Montana, recognizing that large-scale wind energy development will mostly occur east of the continental divide and generally at lower elevation settings. Therefore, we selected species using three criteria: 1) the availability of relatively high quality spatial data; 2) apparent sensitivity to wind or other large-scale industrial development; and, 3) species with generally large ranges (versus more site restricted or incidental, but rare species). For each species or group of species we have briefly summarized published research or widely available information. The purpose of this summary is not meant to be an exhaustive review of wind impacts, but rather as supporting information as to the rationale for evaluating risk. We also recognize that insufficient research exists for many species and response to wind energy development, so our assessment is couched within the context of risk, often rather than known impacts.

Greater Sage-Grouse

In general, prairie grouse including sage grouse (*Centrocercus urophasianus*) exhibit high site fidelity and require extensive intact habitat with open horizons. Montana hosts two species of grouse that are likely to be located in areas of interest for wind development, sage grouse and plains sharp-tailed grouse (*Tympanuchus phasianellus*). Evaluation was restricted to sage grouse, due to well-documented sensitivity to disturbance, the geographic scope of their distribution across the state, and the importance of habitat in Montana for the northern Great Plains population.

Sage grouse are widely distributed across sagebrush grassland habitat in eastern Montana and portions of valleys in southwestern Montana. Sage grouse are entirely dependent

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Figure 4. Low Ecological Risk Lands for Wind Energy Development

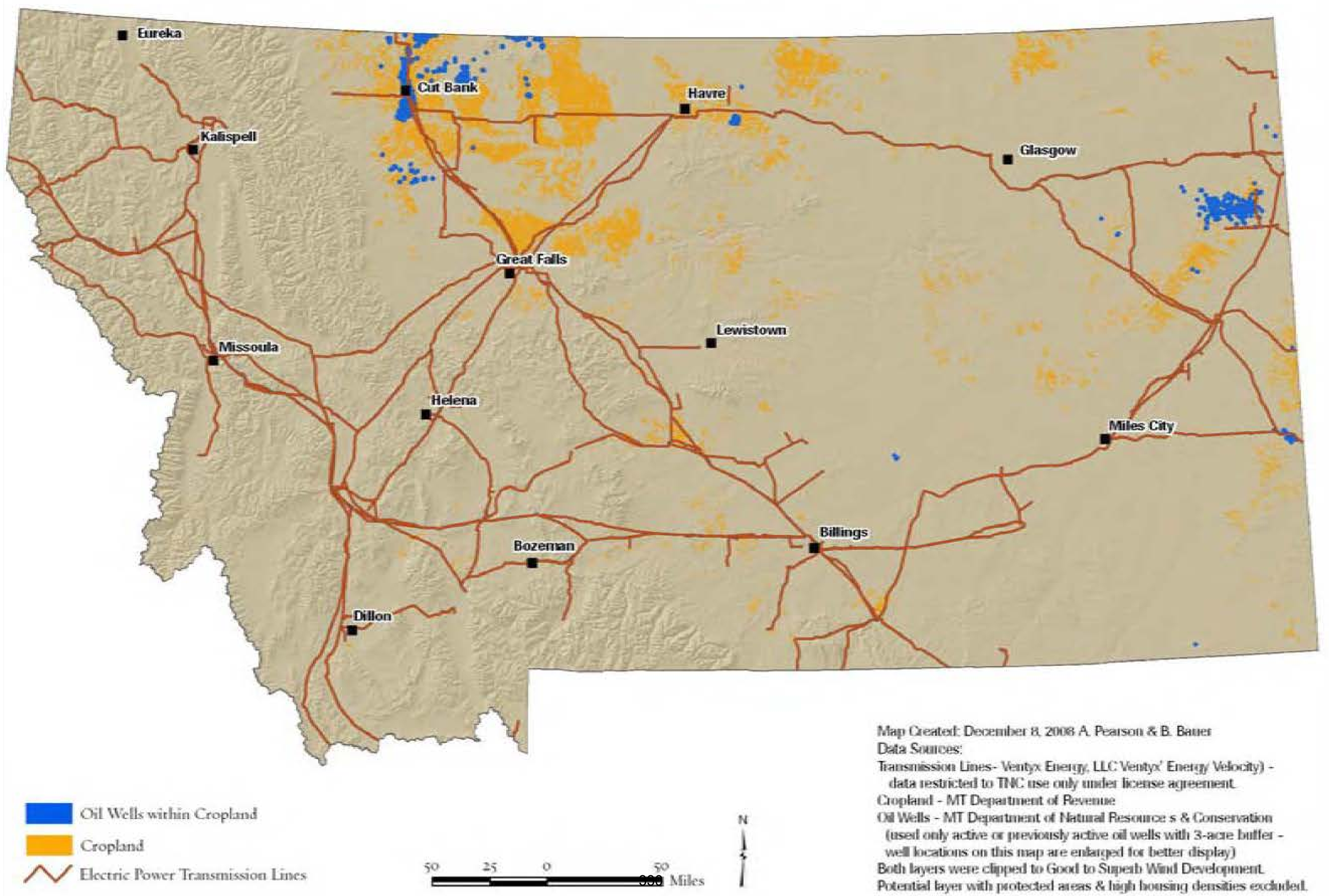

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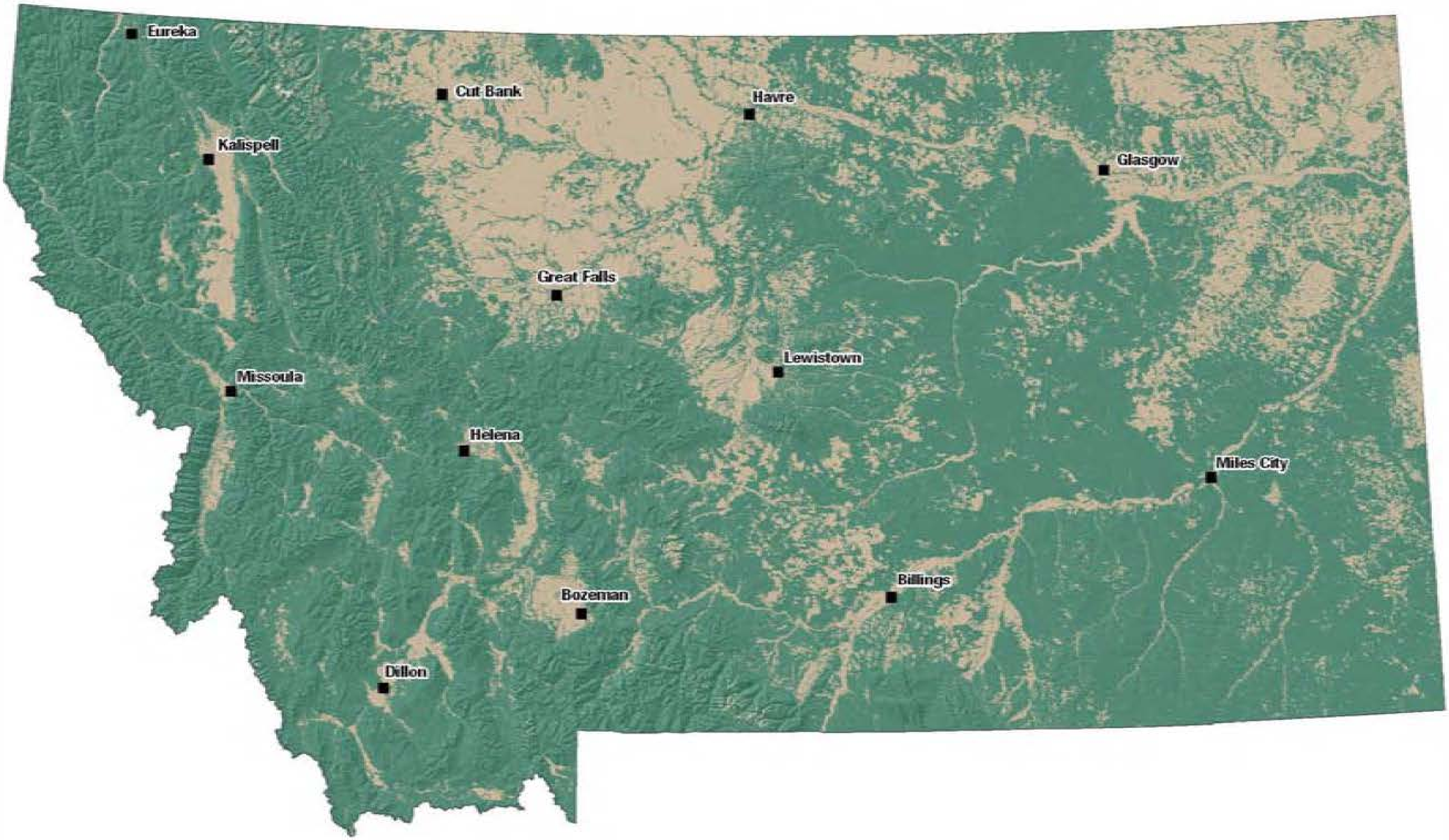
Figure 5. Relatively Intact Natural Habitat



Natural Vegetation

50 25 0 50 Miles

N

Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Natural Vegetation - National Landcover Dataset (2001) -
excluded Water, Developed, Barren, Crop, and Hay values.

upon sagebrush for a portion of their lifecycle and stable populations in the state are largely attributed to relatively large, intact, and good quality habitat. Sage grouse are a long-lived species and females generally breed within about 4 miles or less from a lek (Walker 2008). Birds may travel considerable distances between breeding and wintering grounds.

Impact of wind farms on sage grouse have not been documented, however, it has been suggested that as a large-scale industrial development it may have similar effects as natural gas (shallow and coal-bed) development (Montana Fish, Wildlife and Parks 2005a). In Wyoming, gas development has resulted in wide-scale extirpation or reduction of populations at distances as great as 4 miles from leks (Holloran 2005, Walker 2008). Both gas development and wind farms are characterized by extensive road developments that fragment habitat and increase potential of vehicle collisions. Vertical structures, transmission lines, and turbines may decrease survival or reproductive success as a result of collisions and creation of habitat for predators. Additionally, the structures themselves may alter habitat suitability, resulting in abandonment. One apparent example of this was documented in Idaho, where 8 meteorological towers, 30 to 150 feet in height and topped with anemometers, were installed to measure wind velocity for a commercial wind power feasibility study. Over a period of five years, 7 of 9 sage grouse leks were abandoned and the overall population declined about 75% (Collins and Reynolds 2006). In contrast, sage grouse populations were relatively stable in the remainder of the county where the project was located.

The U.S. Fish and Wildlife Service recommended that wind farms be located 5 miles from active leks to avoid disturbance of prairie grouse (Manville 2004). In our analysis, we utilized data of lek locations for sage grouse from Montana Fish, Wildlife and Parks (MFWP). We have buffered occupied leks a distance of 4 miles (Figure 6 and Figure 7), because research suggests that sage grouse generally nest within 4 miles of a lek (Walker 2007). Wind farm or transmission line construction within the areas highlighted on the map may create high risk for negative impacts to sage grouse, with risk being especially high for smaller and migratory populations. For example, a population that may be especially vulnerable is located in northern Valley County, where birds occupy widely scattered habitat that extends into portions of southern Saskatchewan. This population is also migratory, occupying habitat north of the Milk River during breeding and brood rearing and wintering south of the river.

Grassland Endemic Birds

Endemic grassland birds in North America have been recognized as suffering the most consistent and widespread declines of any avian assemblage in North America (Knopf 1994). As a result, numerous species have been identified as priorities for conservation (Table 1). Because there is substantial habitat overlap among many of these species, we have considered them as a suite, rather than individually. We anticipate that there may be a variety of responses to wind energy development, and some of these species may need to be evaluated individually as data become available.

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Figure 6. Sage Grouse Leks in Montana

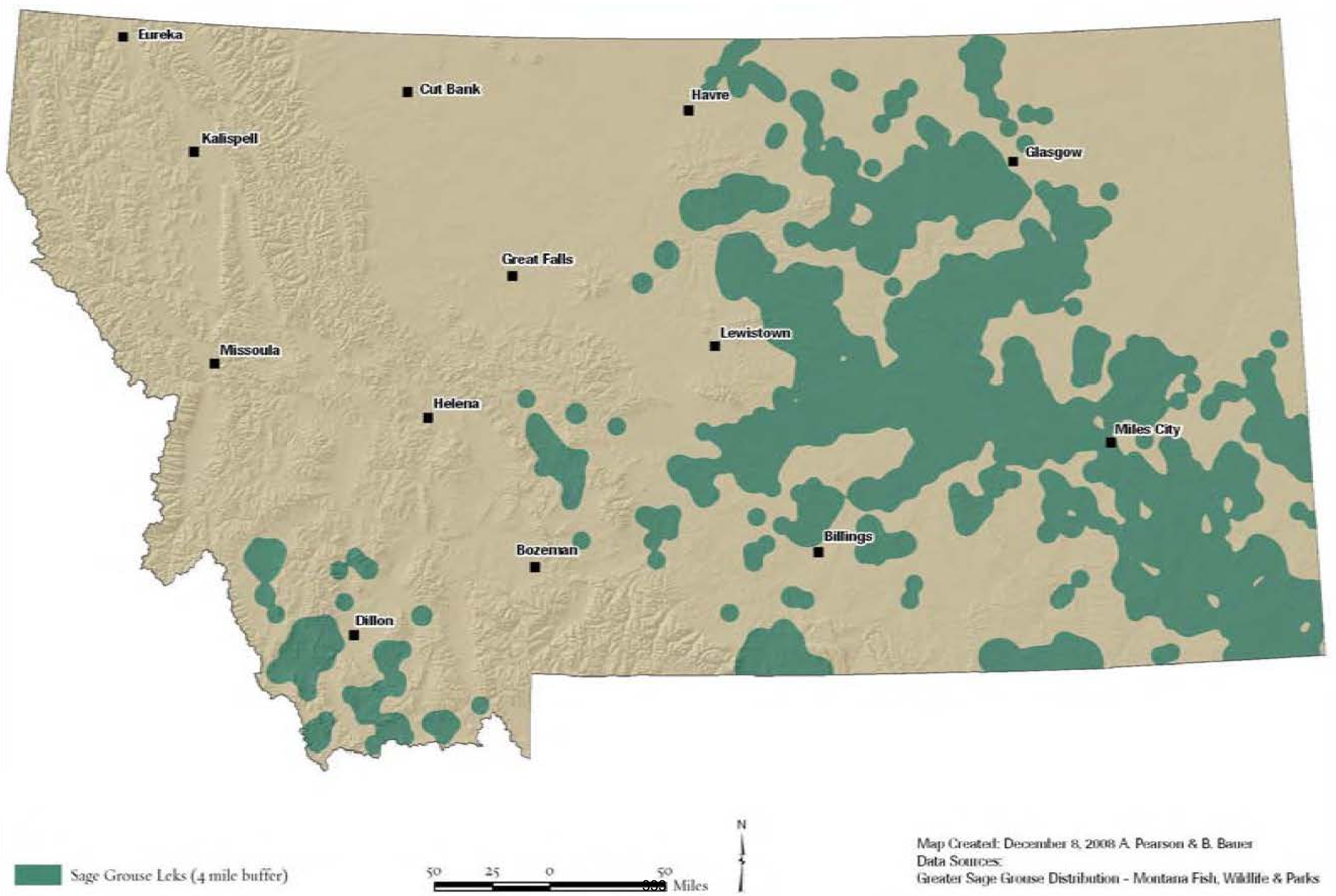

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Figure 7. Sage Grouse Leks within Good-to-Superb Wind Energy Potential

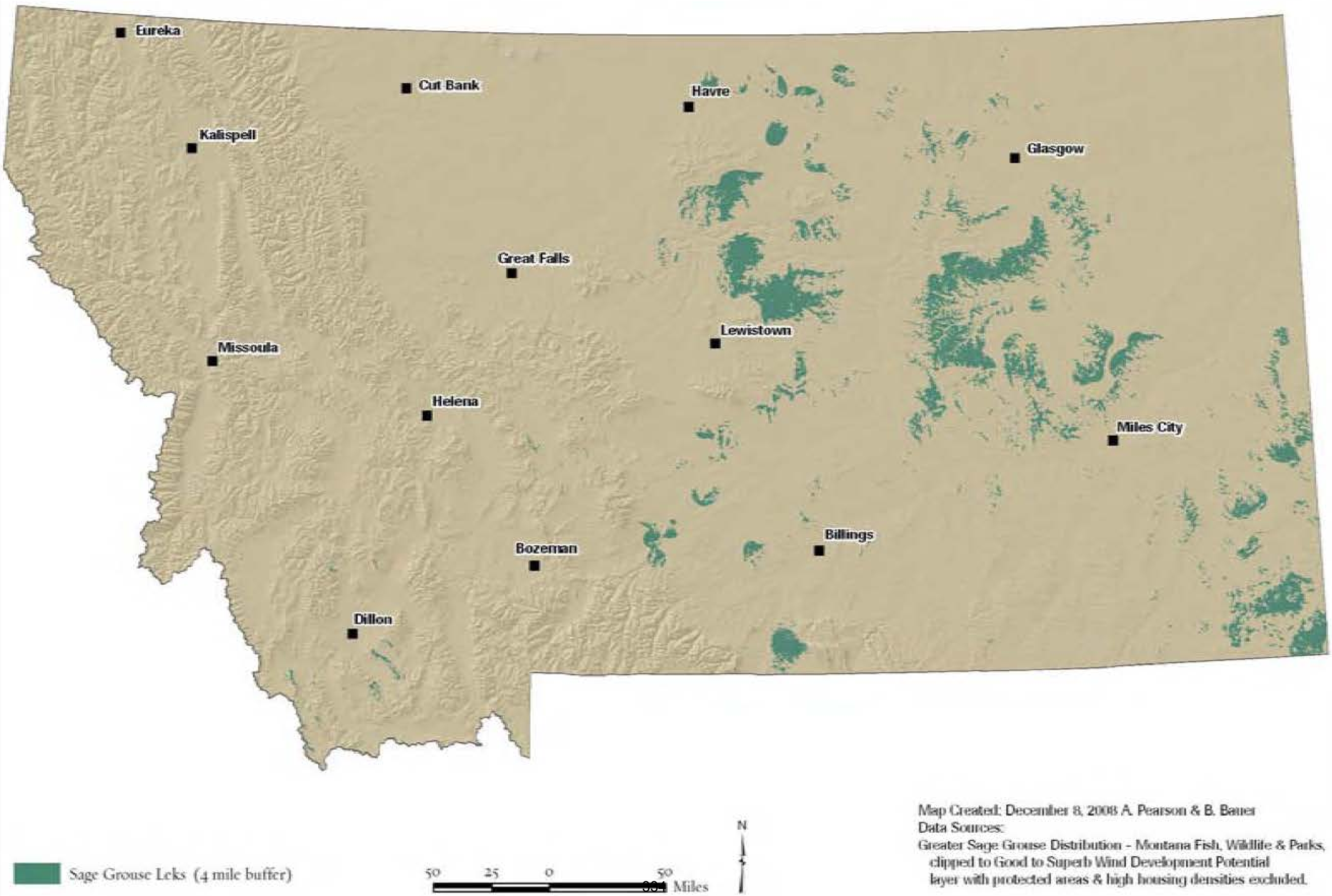

Table 1. Declining Grassland Birds Evaluated for the Risk Assessment

Species	**Conservation Status**		
	Partners in Flight (Casey 2008) or US Shorebird Conservation Plan (2004)	USFWS (2002)	Tier 1 Species State Comprehensive Conservation Strategies
Ferruginous hawk	Regional Concern	BCC	NE, ND, WY
Mountain plover	Highly Imperiled	BCC	MT, NE, WY
Long-billed curlew	Highly Imperiled	BCC	MT, NE, ND, WY
Marbled godwit	High Concern	BCC	ND, SD
Burrowing owl	Regional Concern	BCC	MT, NE, SD
Sprague's pipit	Continental importance	BCC	ND, SD
Lark bunting	Continental importance		MT, ND, SD, WY
Baird's sparrow	Continental importance	BCC	ND, SD
McCown's longspur	Continental importance	BCC	NE, WY
Chestnut-collared longspur	Continental importance	BCC	ND, SD, WY

Mixed-grass prairie in Montana north of the Missouri River, and especially in the north central portion of the state, supports the highest number of declining, breeding grassland birds in North America (Figure 8) (Knopf 1996). Species diversity and abundance is most likely attributable to the diverse geological substrates and associated plant communities, as well as the extensive and relatively intact grasslands, coupled with relatively low human disturbance. The mixed-grass prairie north of the Missouri is especially significant for Baird's sparrow (*Ammodramus bairdii*) and Sprague's pipit (*Anthus spragueii*), both of which have breeding ranges restricted primarily to portions of Montana, North Dakota, Saskatchewan, and Alberta.

Declining populations of many grassland birds have been attributed, in large part, to alteration of disturbance regimes and extensive conversion of habitat to cropland (Samson and Knopf 1994, Fitzgerald et al. 1999, Knapp et al. 1999, Blann 2006). Data from the U.S. Department of Agriculture show that the nation's private grassland and rangeland declined by 25 million acres in just 20 years (1983 to 2003), largely as a result of conversion to cropland (GAO 2007). The greatest losses occurred in the northern Great Plains, specifically in Montana and the Dakotas. Conversion may accelerate in the near future to accommodate a projected four-fold increase in biofuels (Nash 2007, U. S. Department of Agriculture National Agricultural Statistics Service 2007).

The presence of wind turbines may displace some species of grassland birds (Leddy et al. 1999, Johnson et al. 2000), however, data are lacking for most mixed-grass and shortgrass affiliated birds. Response of grassland passerines to wind energy development is currently under investigation in North and South Dakota (Shaffer and Johnson 2008). Very preliminary data suggest that grasshopper sparrow avoid turbines, whereas western meadowlark and chestnut-collared longspur do not avoid turbines. In addition to turbines, construction of roads may negatively impact grassland birds by fragmenting habitat. Sprague's pipit relative abundance and productivity increased with area of available habitat (patch size), and chestnut-collared longspur and Baird's sparrow relative abundances were also influenced by patch size and shape (Davis 2003).

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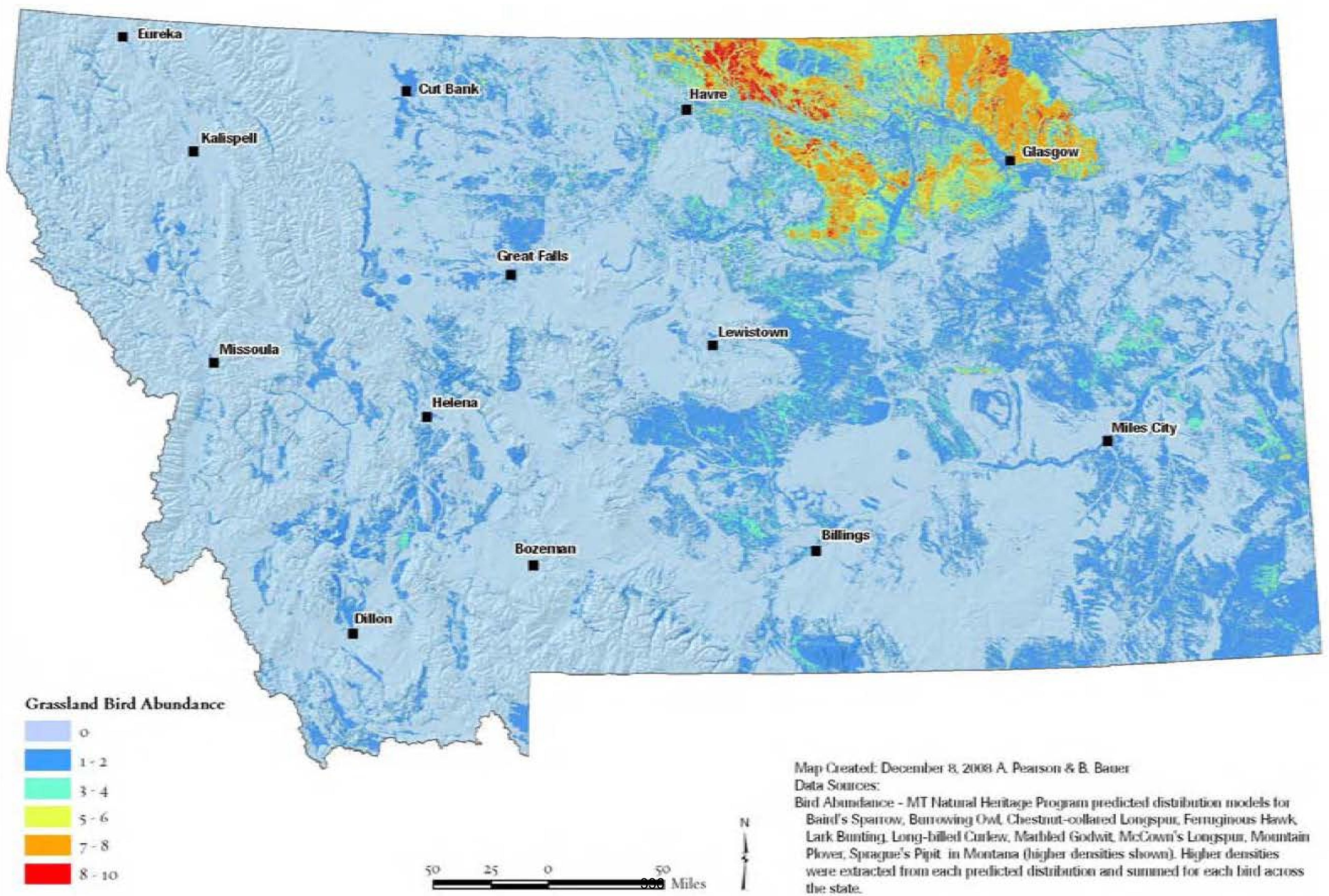
Figure 8. Declining Grassland Bird Predicted Species Diversity in Montana



We utilized the predicted distribution for declining grassland birds as a means of highlighting the geographic portions of the state that supported the largest number of species and potential risk of wind development. As noted above, northcentral Montana (large portions of Blaine, Phillips and Valley counties) is a critical area for grassland birds and a portion of this area overlaps with good or better wind resource potential (Figure 9). Several grasslands and sagebrush grasslands south of the Missouri River also stand out as important habitat for these species. Other areas previously identified through inventory efforts as being important for grassland birds and having good or better wind energy potential included portions of Glacier, Pondera, Teton, and Sheridan counties (Casey 2006).

To strengthen the predicted distribution model, we contracted the Montana Heritage Program to document grassland bird presence and abundance in other grassland regions of the state with limited data, but good wind resource potential. In total, they completed inventories in five areas of the state, Kevin, Bear's Paw, Rapelje, Little Big Sheep, and Baker (Appendix B). In all five areas, the majority of the declining grassland birds identified above were present, and at times with relatively high abundance. This very preliminary inventory points to the need for additional efforts to document declining grassland bird abundance to help guide wind farm siting.

Piping Plover and Interior Least Tern

The northern Great Plains (NGP) population of piping plover (*Charadrius melodus*) was listed as threatened in the United States and endangered in Canada in 1985. Each summer, 25 to 40% of the NGP population (50 to 80% of plovers in the U.S. NGP) nest on open beaches associated with alkali wetlands in an eight-county area of northwestern North Dakota and northeastern Montana (Plissner and Haig 2000a), with most of the remaining birds nesting on the Missouri River system. In Montana, piping plovers are primarily located on alkali wetlands in Sheridan County, with a smaller population associated with sandbar habitat on the Missouri River below Fort Peck Dam and on barren beaches associated with Fort Peck Reservoir (Atkinson and Dood 2005) (Figure 10). Very small populations are also found at Bowdoin National Wildlife Refuge, Nelson Reservoir, and Alkali Lake in Pondera County.

Stewart et al. (2007) reviewed numerous avian and wind studies and noted that birds in the order Charadriiformes (shorebirds) were among those most impacted by wind energy globally (second only to waterfowl). Recent declines in plover numbers have been largely attributed to inadequate productivity stemming from extraordinary predation on eggs and chicks (Larson et al. 2002, Plissner and Haig 2000*b*, Ryan et al. 1993). Predators such as striped skunks, raccoons, great-horned owls, American crows, and ring-billed gulls that were uncommon on the prairie landscape are now numerous, due to planted trees, increased woody cover, rockpiles, junkpiles, utility poles, abandoned buildings, and supplemental food sources that provide habitat and resources for them. Locating wind energy development in proximity to breeding or foraging habitat may further contribute to already fragmented habitat and provide additional habitat for predators.

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Figure 9. Declining Grassland Bird Predicted Species Diversity within Available Good-to-Superb Wind Energy Potential in Montana

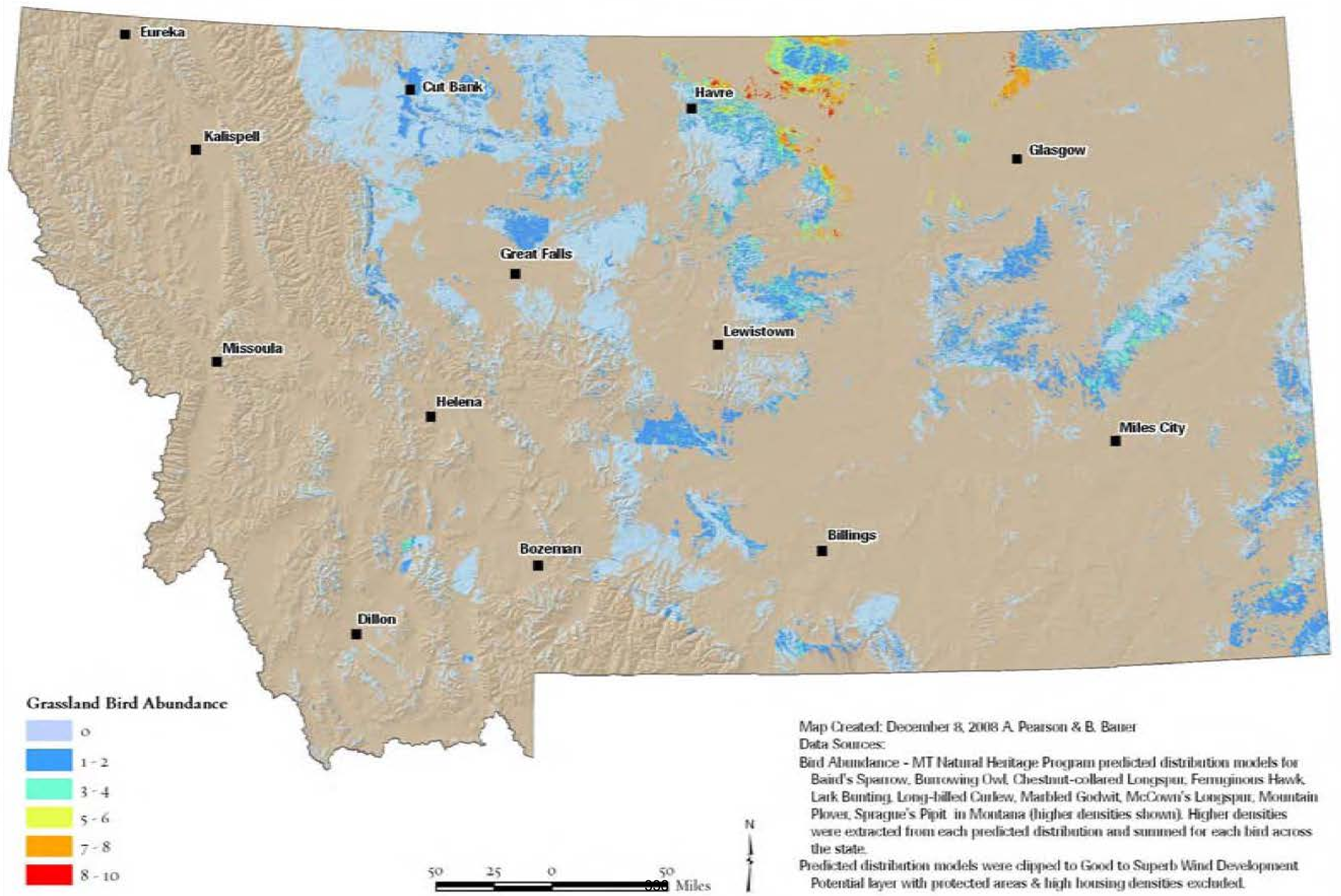

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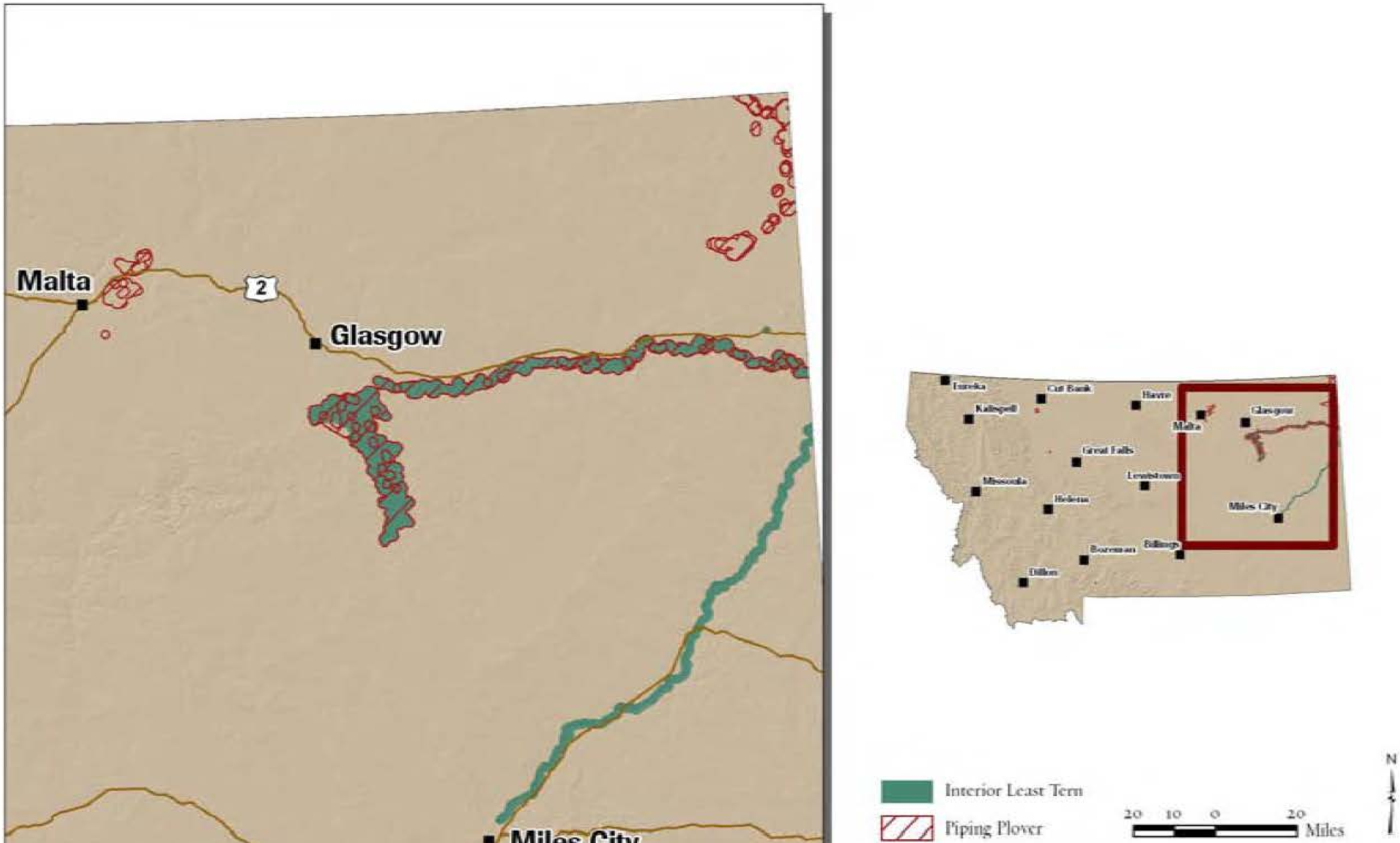
Figure 10. Piping Plover and Interior Least Tern Breeding Habitat in Montana



Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Piping Plover w/ 1 mile buffer- US Fish and Wildlife Service (nesting locations), MT Natural Heritage Program (element occurences).
Interior Least Tern w/ 1 mile buffer- MT Natural Heritage Program (element occurences)

Interior least tern (*Sterna antillarum*) was listed as endangered in 1985, primarily due to loss of sandbar habitat associated with large interior rivers. In Montana, this species is found primarily on the lower Missouri below Fort Peck Dam and the lower Yellowstone River below Miles City (Atkinson and Dood 2006).

Terns may be susceptible to direct mortality from collisions with turbines. A wind farm constructed on a coastal wetland, which provided breeding habitat for three species of terns had an average collision rate 6.7 birds per turbine per year over a two year period (Everaert and Steinen 2006). Presence of the wind farm did not appear to displace the terns.

Due to intensive census efforts, habitat for piping plover and interior least tern has been well studied and described. To identify risk potential for piping plover we used data from the U.S. Fish and Wildlife Service that indicate where they breed at alkali lake basins in Sheridan County. Populations of piping plover outside of Sheridan County and for interior least tern were available as element occurrence data through the Montana Natural Heritage Program. Although there is not good guidance on distance recommendations, we selected a 1-mile buffer around each breeding location (Figure 11). The potential for wind energy development potential is relatively low along the riparian habitat of the Missouri and Yellowstone rivers utilized by both species, being mapped as marginal wind resource potential. Wind energy potential in the remaining habitat associated with alkali lakes in Sheridan County is primarily mapped as fair, whereas a portion of habitat on Fort Peck is rated as good. Given the protected status of both species, frequency of collisions of shorebirds with wind turbines in other areas, and limited wind resources in these areas, risks of development in plover and tern habitat appear to far outweigh return from potential wind development.

Waterfowl, waterbirds, and wetland concentration areas

In review of wind farm impacts, Stewart et al. (2007) noted that waterfowl and wading birds experienced the most consistent declines in abundance of all bird groups. They recommended caution in development in waterfowl concentration areas. Montana provides significant habitat for numerous wetland-associated species. The most recognized of these areas is the Prairie Pothole Region, which provides breeding habitat for the majority of the continent’s breeding ducks, as well as significant habitat for numerous waterbirds. In Montana, the Prairie Pothole Region encompasses portions of the northern tier of counties from the North Dakota border to the Rocky Mountains. Some of the key habitat and high concentration areas have been protected as National Wildlife Refuges, including Benton Lake, Bowdoin, and Medicine Lake or State Wildlife Management Areas, such as Freezout Lake. Other critical habitat that coincides with good to superb wind potential is throughout northern Montana, with especially significant wetland complexes in portions of Sheridan, Phillips, Blaine, Liberty, Glacier, Pondera, and Teton counties and in some of the intermountain valleys (Bitterroot, Blackfoot, Centennial, Flathead, and Swan).

Utilizing National Wetland Inventory data, we have identified areas of highest wetland concentrations, where mapping has been completed (Figure 12). Portions of the Prairie

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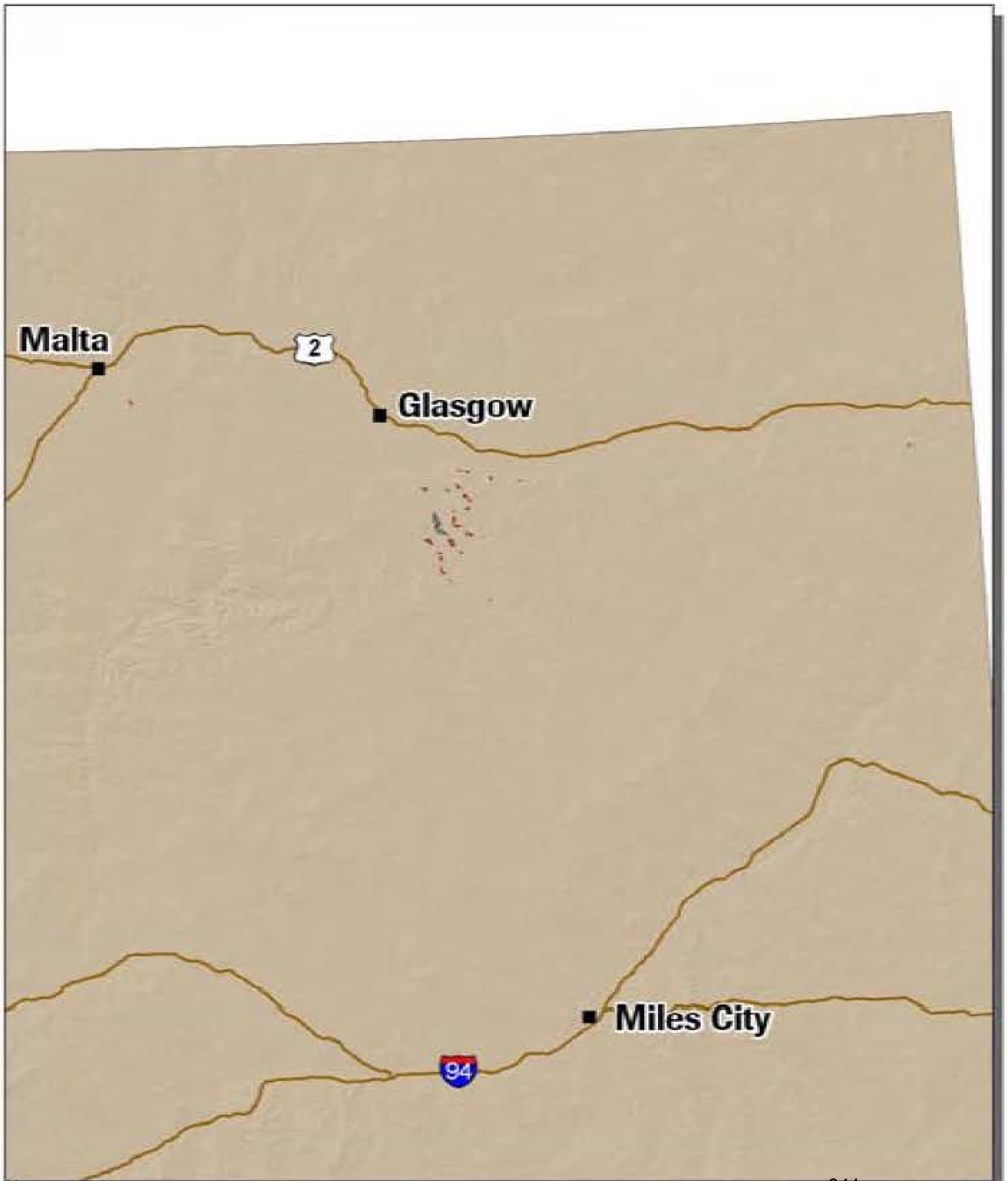
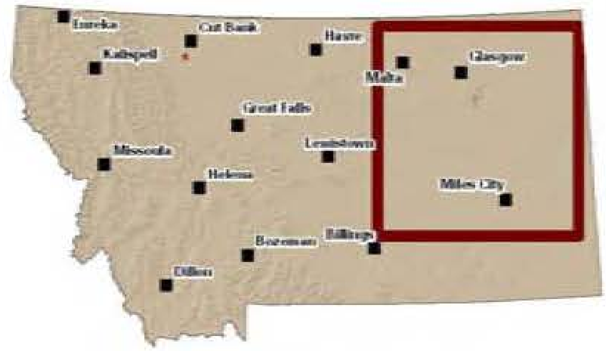
Figure 11. Piping Plover and Interior Least Tern Breeding Habitat within Available Good-to-Superb Wind Energy Potential in Montana





Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Piping Plover w/ 1 mile buffer- US Fish and Wildlife Service (nesting locations), MT Natural Heritage Program (element occurences).
Interior Least Tern w/ 1 mile buffer- MT Natural Heritage Program (element occurences)
Both species occurences were clipped to Good to Superb Wind Development Potential layer with protected areas & high housing densities excluded

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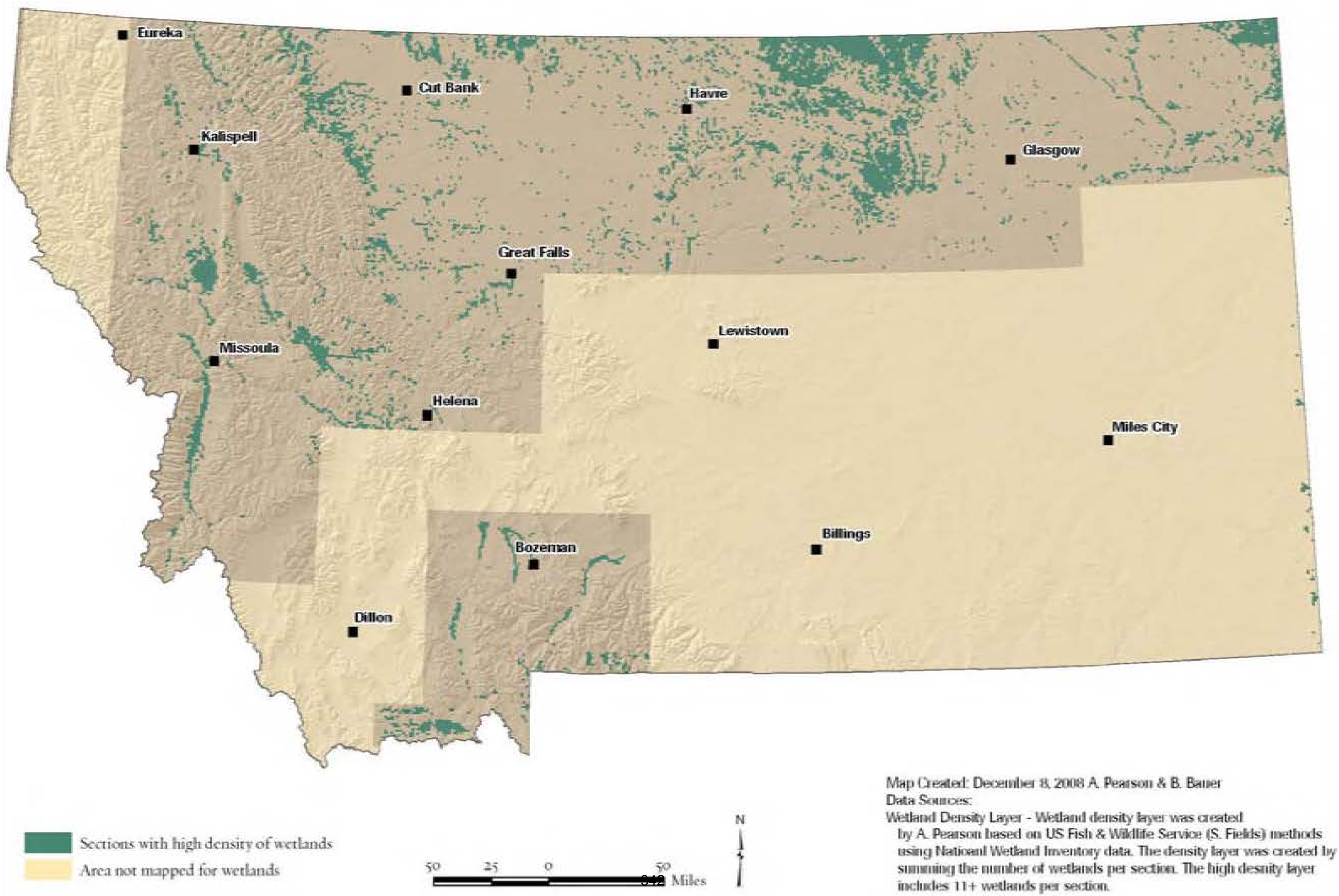
Figure 12. High Wetland Densities in Montana



Pothole Region are coincident with good or better wind energy potential, especially along the Rocky Mountain Front from Glacier to Teton county (Figure 13). While wetlands are generally most productive as waterfowl habitat in areas embedded in grasslands, even in intensively cropped locations, wetlands may still attract significant numbers of breeding or migrating waterfowl. Therefore, wind energy development in wetland concentration areas across the state poses a potentially high risk for negative impacts.

Bats

Wind energy development has been demonstrated through numerous studies and monitoring efforts to kill large numbers of bats in some locations (Kunz et al. 2007). It is likely that the number of bats killed is greater than estimated, due to errors in sampling, suggesting that the numbers killed may be greater than already acknowledged (Smallwood 2008). Mortality is the result of direct collisions, as well as, barotrauma, rapid pressure reductions caused by wind turbines, which causes fatal lung damage (Baerwald et al. 2008).

Mortality among bats is highest among migratory tree roosting species, and the fatalities occur in greatest numbers during fall migration when juveniles are present (Kunz et al. 2007). Recent research for hoary bat (*Lasiurus cinereus*) suggested that relatively low wind speeds, low moon illumination, and relatively high degrees of cloud cover were important predictors of migration (Cryan and Brown 2007). While fatalities have been most often recorded to be the highest in the eastern United States, mortality of hoary bats in Montana is expected to be most similar to mortality patterns reported from a wind farm in southwestern Alberta (Barclay et al. 2007). Due to the fact that bats are long-lived and have low reproductive rates, mortality caused by wind farms may result in significant population declines and local extinctions.

Fifteen species of bats breed in Montana, and of these, seven are listed by the Montana Natural Heritage Program and MFWP (2008) as species of concern. All three species most frequently killed by wind turbines occur in Montana, silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*) and hoary bat, with the latter two being species of concern (Kunz et al. 2007, Arnett et al. 2008). All three of these species roost in riparian and forested habitats and migrate long distances.

To address the potential risk of wind energy development on bats in Montana, we utilized predicted distributions for 13 species of bats developed by the Montana Natural Heritage Program (Table 2). Figure 14 shows predicted bat species diversity across the state. Areas for breeding species which stood out as especially important were coniferous forests in the western portion of the state, the Pryor Mountains and surrounding area south of Billings, extensive ponderosa pine habitats in the eastern part of the state (e.g., Bull Mountains), and significant riparian habitat along larger rivers, including the Yellowstone, portions of the Missouri, Powder, and Tongue. Considering only species diversity, it appears that the area around the Pryor Mountains, the Big Snowy Mountains, Little Rockies, and portions of the Little Belt Mountains has the highest potential for risk among breeding species of bats (Figure 15). Hoary and silver-haired bat were present in all five locales inventoried with good or better wind potential (Appendix B), suggesting

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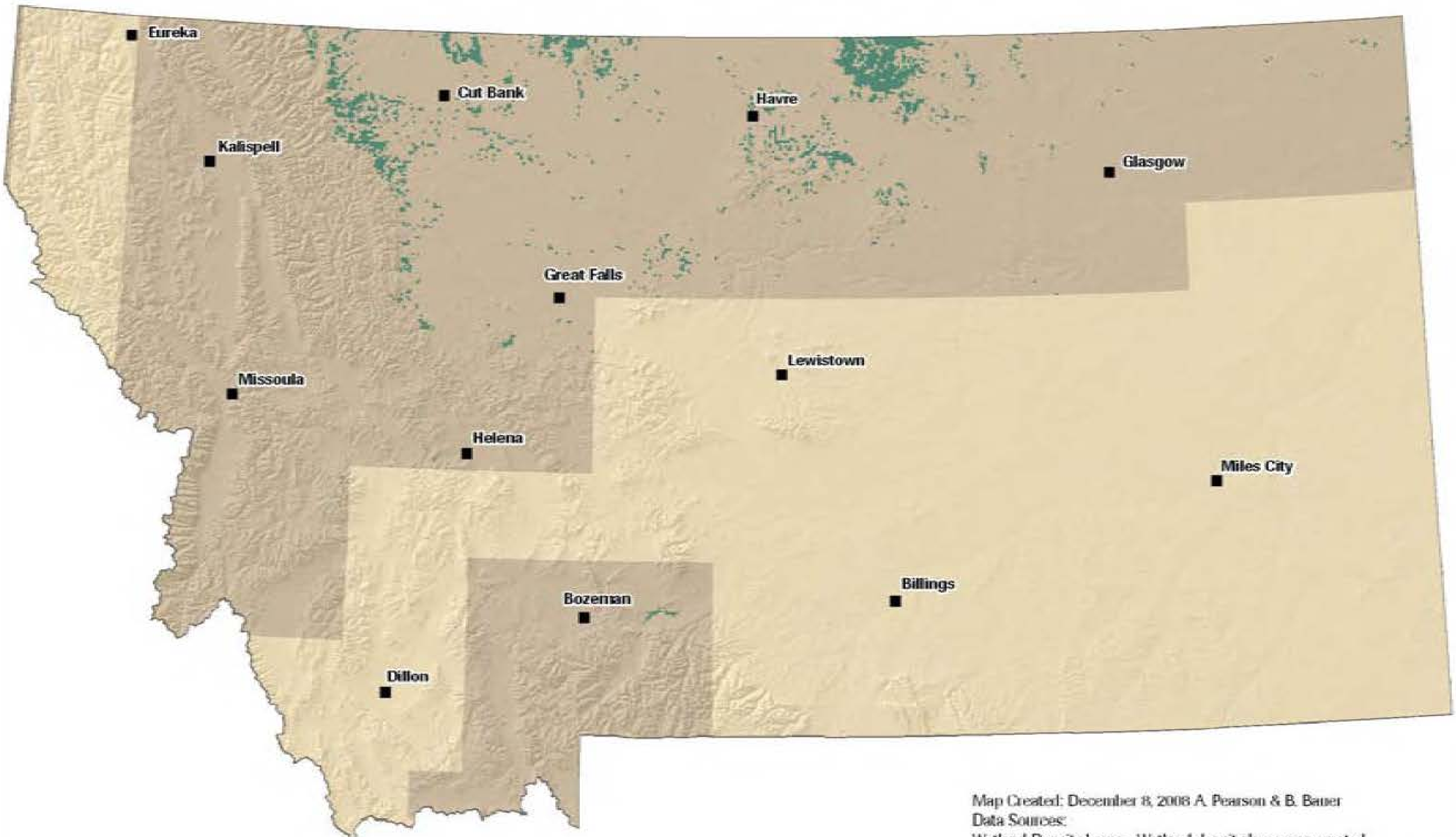
Figure 13. High Wetland Densities within Available Good-to-Superb Wind Energy Potential in Montana



Sections with high density of wetlands
Area not mapped for wetlands

50 25 0 50 Miles

N

Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Wetland Density Layer - Wetland density layer was created by A. Pearson based on US Fish & Wildlife Service (S. Fields) methods using Natioanl Wetland Inventory data. The density layer was created by summing the number of wetlands per section. The high desnity layer includes 11+ wetlands per section.
The Wetland Density Layer was clipped to Good to Superb Wind Development Potential layer with protected areas & high housing densities excluded.

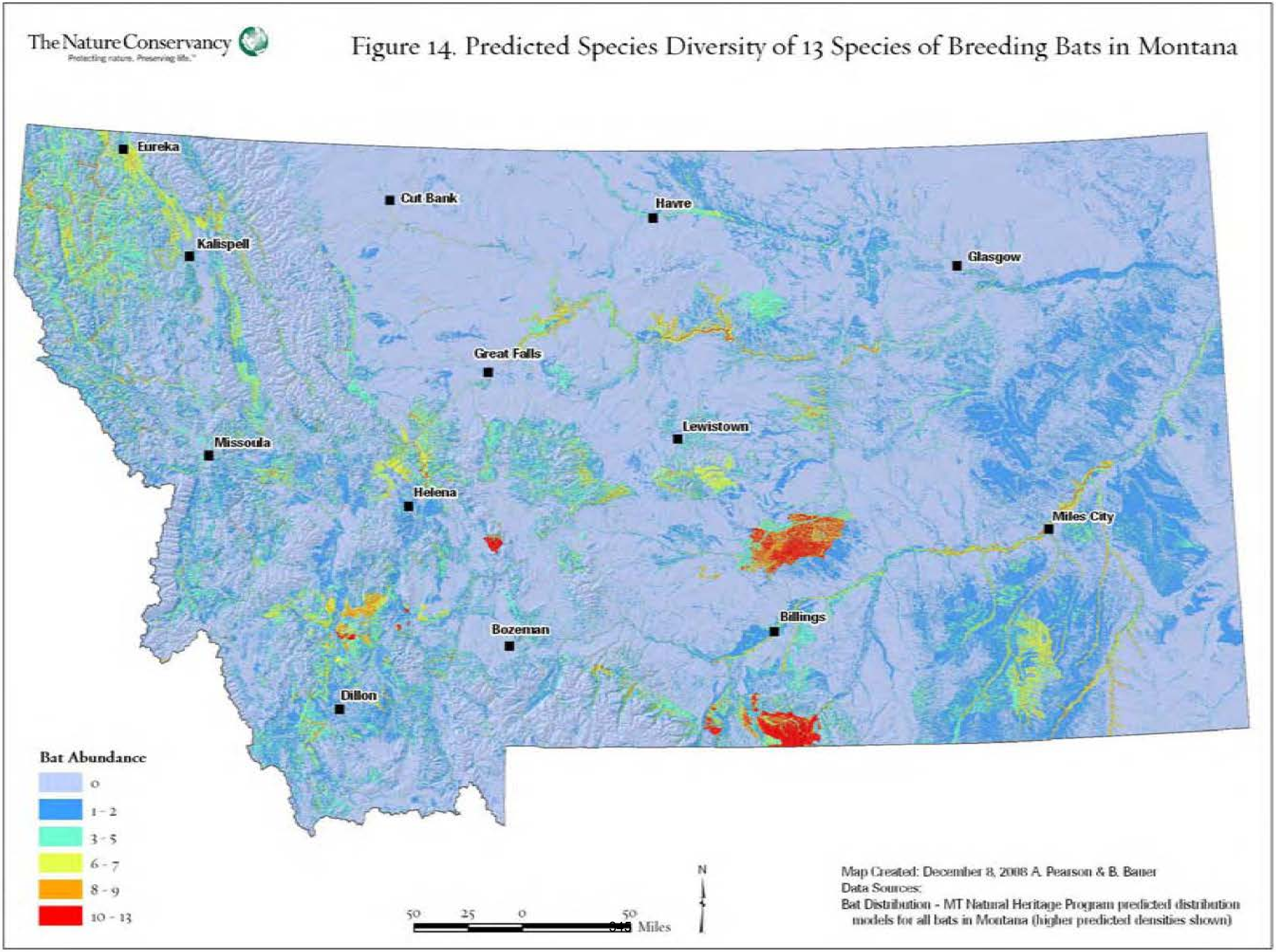

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Figure 14. Predicted Species Diversity of 13 Species of Breeding Bats in Montana
Eureka
Cut Bank
Havre
Kalispell
Glasgow
Great Falls
Lewistown
Missoula
Helena
Miles City
Billings
Bozeman
Dillon
Bat Abundance
0
1 - 2
3 - 5
6 - 7
8 - 9
10 - 13
50 25 0 50 Miles
N
Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Bat Distribution - MT Natural Heritage Program predicted distribution models for all bats in Montana (higher predicted densities shown)

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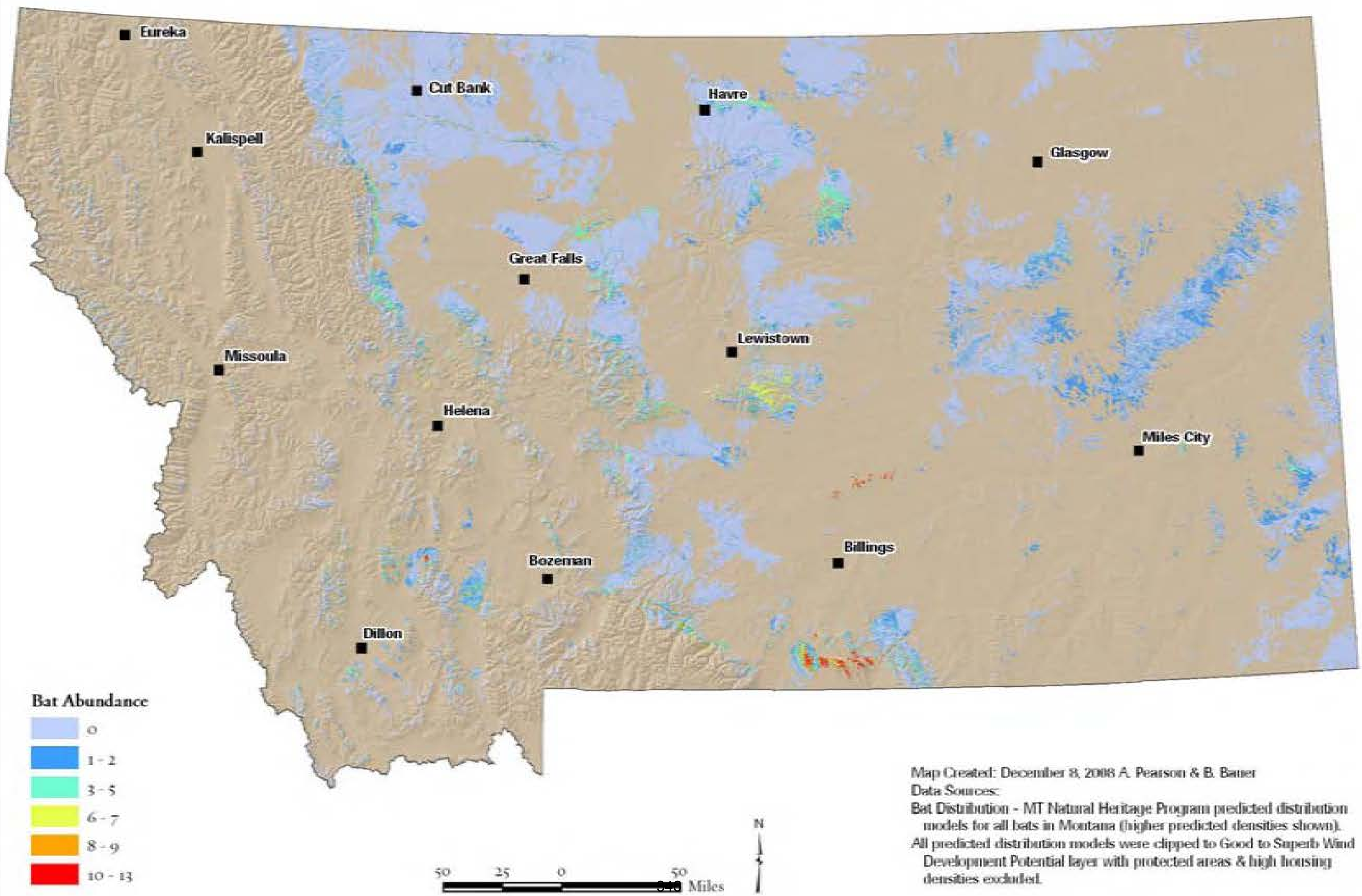
Figure 15. Predicted Species Diversity of 13 Species of Breeding Bats in Montana within Good-to-Superb Wind Energy Potential



that substantially more data are needed on individual species, especially those that are most susceptible to direct mortality.

In general, several species of bats frequent riparian habitat and open water for foraging, suggesting that for site-level decisions, turbines should be avoided in these habitats as they may have higher risk for mortality. To date in the West, the highest incidence of bat mortality has occurred during migration. Because we lack data on migratory patterns of bats in Montana, emphasis should be placed on researching migration locations and timing to determine if siting can be accomplished to minimize impacts or whether other management actions, such as feathering down turbines during migration may be required.

Table 2. Bat Species Predicted Distribution Selected for Risk Assessment.

Species	**Scientific Name**	**Montana Habitat**	**Status**
Big brown bat	*Eptesicus fuscus*	Wide variety of habitats with roosts in natural cavities and manmade structures	
California myotis	*Myotis californicus*	Usually forested habitats in mountainous regions, but also found in open habitats	
Eastern red bat	*Lasiurus borealis*	Riparian cottonwoods	Species of concern
Fringed myotis	*Myotis thysanodes*	Riparian and dry mixed conifer	Species of concern
Hoary bat	*Lasiurus cinereus*	Riparian and forest	Species of concern
Long-eared myotis	*Myotis evotis*	Wooded and rocky areas	
Long-legged myotis	*Myotis volans*	Usually forested habitats with roosts in natural cavities and manmade structures	
Pallid bat	*Antrozous pallidus*	Arid landscapes rock outcrops	Species of concern
Spotted bat	*Euderma maculatum*	Arid landscapes rock outcrops	Species of concern
Silver-haired bat	*Lasionycteris noctivagans*	Wide variety of habitats with roosts in natural cavities and manmade structures	
Townsend's big eared bat	*Corynorhimus townsendii*	Forested areas in landscapes with caves	Species of concern
Little brown myotis	*Myotis lucifugus*	Wide variety of habitats with roosts in natural cavities and manmade structures	
Western small footed myotis	*Myotis ciliolabrum*	A variety of more open and arid habitats with roosts in natural cavities and manmade structures	

Grizzly bear

Significant wind energy potential exists along the Rocky Mountain Front (Front), defined as the area encompassing the transition of the mountains and plains stretching from the Canadian border to Rodgers Pass and extending eastward approximately 30 miles. This area is home to a diverse mixture of wildlife species and often is recognized as sustaining some of the highest quality wildlife habitat in the Nation. Among the species occurring on the Front is the last remaining population of Great Plains dwelling grizzly bear (*Ursus arctos*). Grizzlies seasonally occupy various habitats along the Front, showing preference for riparian and wetland habitat, but also utilizing grasslands. These habitats are among the most productive for grizzly bear in the United States.

Grizzly bear were listed as a threatened species in 1975, due to direct mortality and loss or degradation of habitat. Grizzly bears consistently underutilize habitat and experience higher mortality near roads or other human facilities (Mattson et al. 1996). Vehicle collisions and malicious killing near roads are currently among the most important sources of human-caused mortality in the Northern Continental Divide Ecosystem. As noted previously, wind energy development at commercial-scale requires extensive road development and on-going vehicle traffic to maintain turbines.

We overlaid an existing predicted habitat model (IGBC 2004) for grizzly bear on the Front (Figure 16), with wind energy potential (Figure 17). Development of wind energy presents a significant risk to the persistence of grizzly bear along portions of the Front. While upland ridges would be of greatest value for wind development, the model classified these areas as of lower value to grizzly bears. However, on-going research using satellite transmitters suggests that these areas are frequented by bears for travel between riparian areas and as foraging habitat. Development of these ridges would reduce grassland habitat use, increase mortality, and fragment linkages between riparian habitats.

We did not utilize other grizzly bear data to evaluate the risk of wind energy development for the species in other portions of its range in Montana. Rationale for this primarily related to location of key habitat for bears and wind energy development potential. Most of the remaining populations are in areas where development is prohibited or is of good or better wind energy potential primarily along the ridgelines of mountains. Wind development along ridgelines faces numerous operational obstacles (roads, transmission lines, maintenance). Therefore, the primary concern for other grizzly bear populations in the state would be more in relation to corridors, which are still in the process of being identified.

Mule deer, antelope, and elk winter range

Mule deer, antelope, and elk have been noted to be susceptible to intensive energy development associated with oil and gas production, as well as other extensive development with road networks. Wind farms are not likely to occur at the same scale (at least initially) as oil and gas development, therefore, we have restricted our analysis to winter range considerations, as these species are perhaps most susceptible to disturbance during winter. We also recognized that all three species are sensitive to construction activities in migration routes, although we lacked good data that adequately presented migration corridors for all three species. For example, on-going research on antelope in eastern Montana has just begun documenting what appears to be the longest big game migration in the lower 48 states (S. Forrest personal communication).

Winter range locations of each species were available from MFWP (Figure 18). Because these species occur over large expanses of Montana, considerable overlap exists between winter range and good to superb wind resources (Figure 19). Decisions about potential impacts on each species will most likely need to be evaluated on a project-level basis, but in general, wind energy development should be avoided in the most critical habitats.

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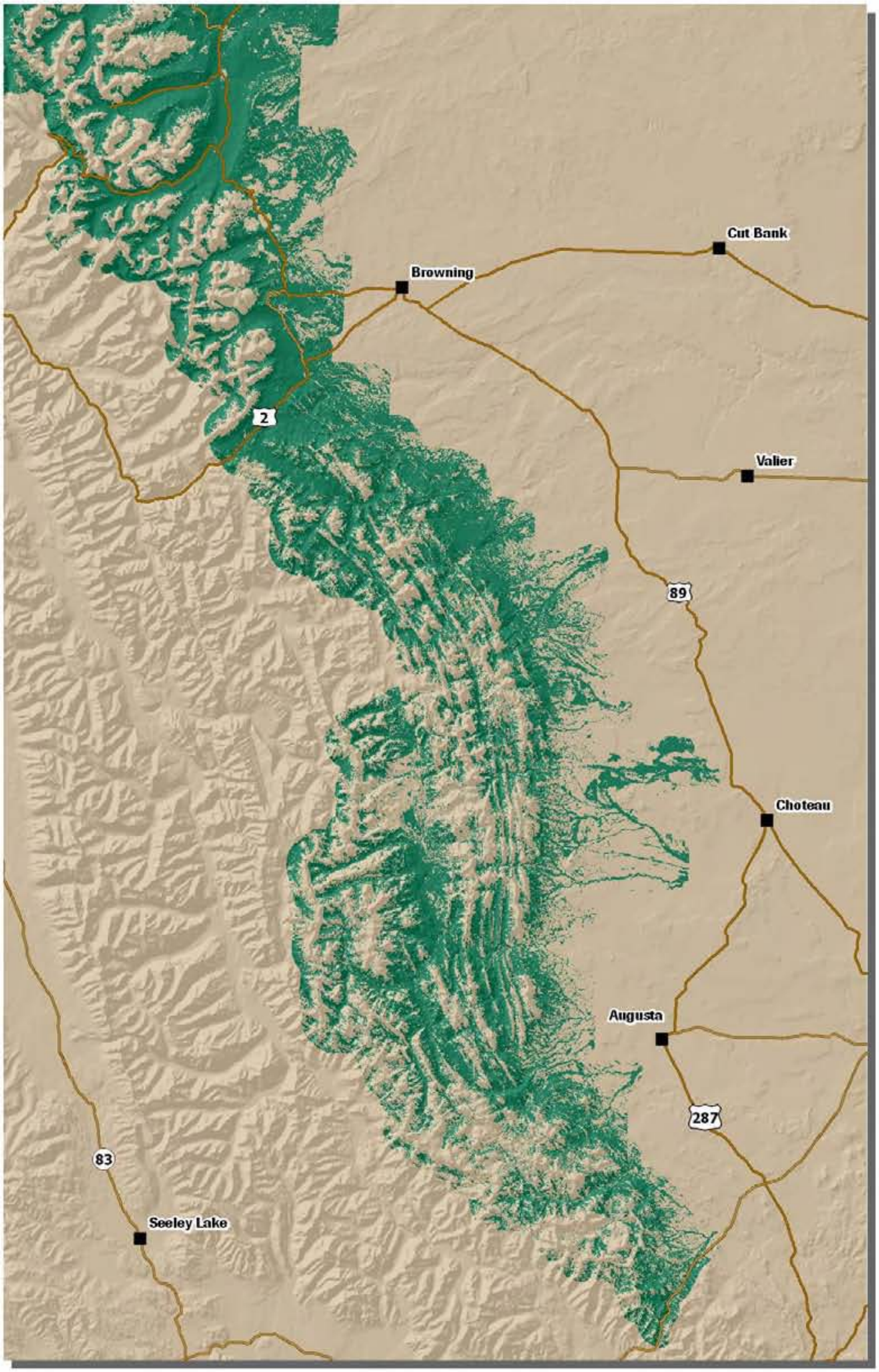
Figure 16. Grizzly Bear Modeled Habitat along the Rocky Mountain Front



High Probability of Use by Grizzly Bears

10 5 0 10 Miles

N

Map Created: December 8, 2008 A. Pearson and B. Bauer
Data Sources:
Grizzly Bear Layer - Cumulative Effects Model (CEM) for the Northern Continental Divide Ecosystem (US Forest Service & CEM Working Group, 2003). Resource Selection Function (RSF) values 6+ were extracted for Habitat Value (Potential Value) in Spring. Habitat Value represents the value in the absence of human activities across the landscape. RSF is a scale from 0-100 as the probability of Grizzly Bears using the landscape.

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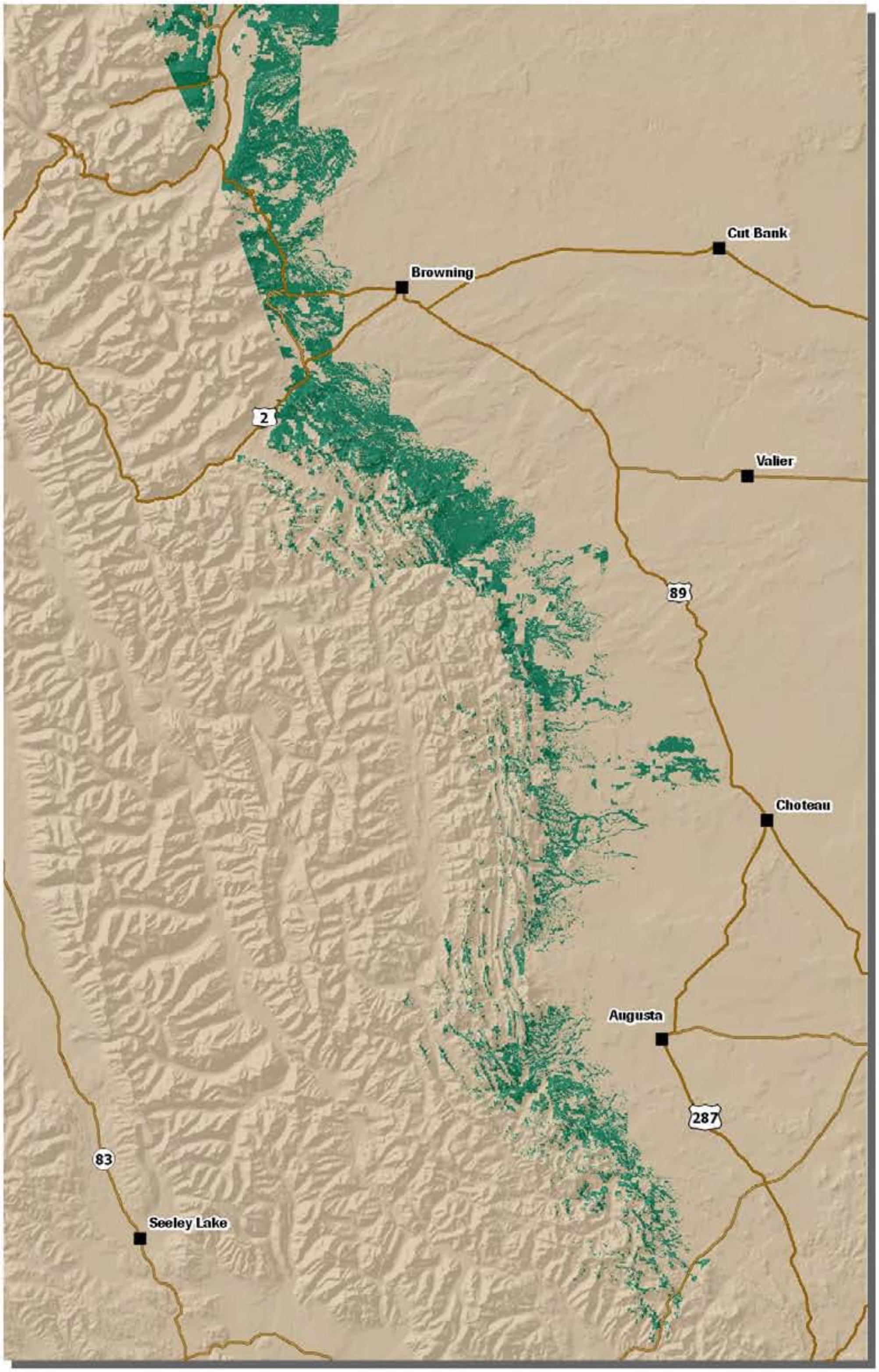
Figure 17. Grizzly Bear Modeled Habitat along the Rocky Mountain Front within Available Good-to-Superb Wind Energy Potential



High Probability of Use by Grizzly Bears

10 5 0 10 Miles

N

Map Created: December 8, 2008 A. Pearson and B. Bauer

Data Sources:

Grizzly Bear Layer - Cumulative Effects Model (CEM) for the Northern Continental Divide Ecosystem (US Forest Service & CEM Working Group, 2003). Resource Selection Function (RSF) values 6+ were extracted for Habitat Value (Potential Value) in Spring. Habitat Value represents the value in the absence of human activities across the landscape. RSF is a scale from 0-100 as the probability of Grizzly Bears using the landscape. For this map, the Grizzly Bear data was clipped to Good to Superb Wind Development Potential layer with protected areas & high housing densities excluded.

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Figure 18. Mule Deer, Antelope, and Elk Winter Range in Montana

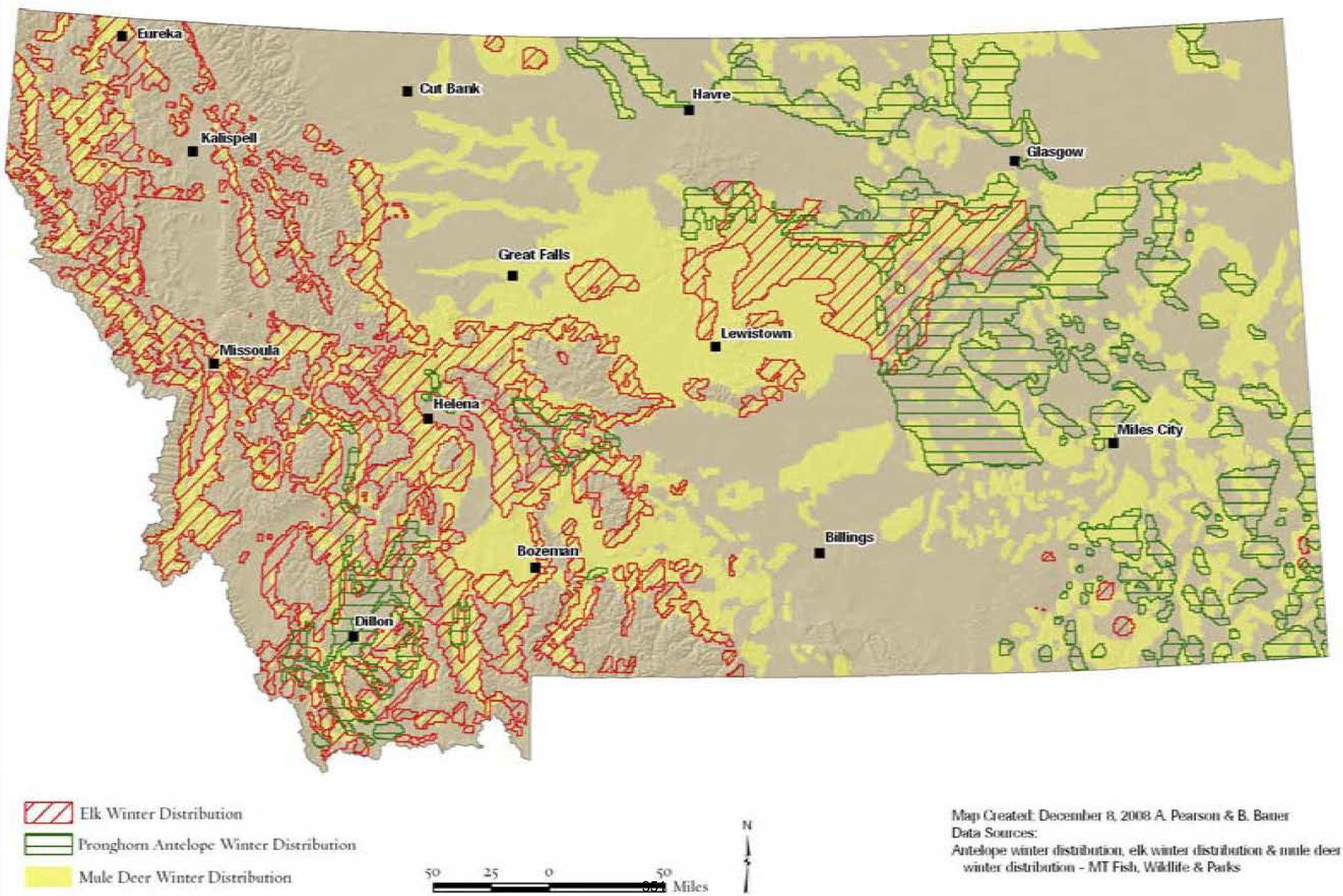

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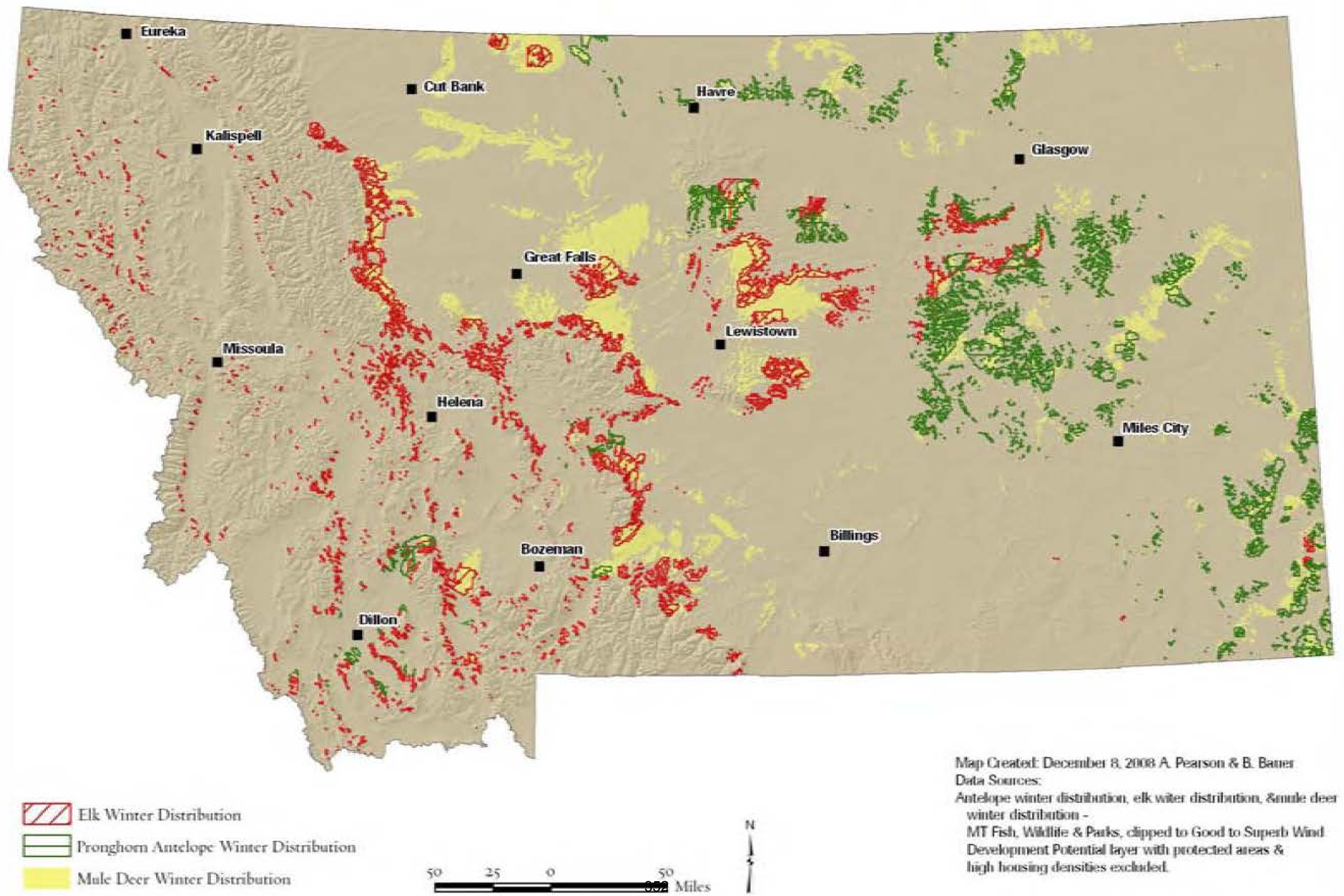
Figure 19. Mule Deer, Antelope, and Elk Winter Range within Available Good-to-Superb Wind Energy Potential in Montana



LANDSCAPE CONSIDERATIONS

Extensive conservation planning has been completed within Montana to identify species in greatest need of conservation and landscapes of greatest ecological importance for supporting those species. The Nature Conservancy (TNC) recognizes six ecoregions within Montana and has developed ecoregional assessments for each, with revision currently in process for the Northern Great Plains Steppe (Figure 20). It should be noted that the portfolio sites identified mostly intact habitats and were selected to both capture species of conservation concern, as well as common species. MFWP has also completed substantial planning through the development of a comprehensive wildlife strategy for the state, which prioritized conservation and inventory efforts (MFWP 2005b). MFWP is currently building on that effort and is in the process of developing a crucial areas and connectivity assessment (personal communication MFWP).

Among the portfolio sites identified by TNC, several have extensive areas of good to superb wind resources. Among the most notable are the Bear's Paw Mountains, Beartooth Front, Big Sheep Mountains, Montana Glaciated Plains, Porcupine Creek Shrublands, Pryor Mountains, Rocky Mountain Front, and Slim Buttes (Figure 21). Numerous other portfolio sites have lesser, but potentially still significant good to superb wind resources. In addition to those areas frequented by species noted above, wind energy development within these portfolio sites has greater risk of ecological impacts for other species of concern not treated in this analysis.

CONCLUSION

Montana has significant wind energy potential and it also contains some of the continent's most intact and valuable wildlife habitat. Developing wind energy within the state that protects wildlife habitat can be achieved. We estimate that in total about 17 million acres of available good-to-superb wind energy potential exists within Montana. Of that total, we have identified roughly 7.7 million acres with high risk (Figure 22 and 23). We strongly suggest that these areas be avoided as locations for wind energy development, rather than considering mitigation approaches, as the lands identified are often critical habitat for multiple species.

Through our analysis we have identified about 9.2 million acres that most likely present a lower risk of impact to resident and breeding species. This total includes the roughly 4.4 million acres of cropland we noted earlier in the report, as well as other areas. In considering the low risk lands, we have most likely over estimated the total number of acres for three reasons. First, while we attempted to consider risk for a broad diversity of species that will most likely be impacted by wind energy development, we may have overlooked species that may be especially vulnerable. Second, we biased our species selection to those that occur mostly in lower elevations, east of the continental divide. We did not consider, for example, the suite of forest carnivores present in the western portion of the state. Third, we lack data for large portions of Montana. As we noted previously we contracted for limited inventory of birds and bats in five regions of the state with good or better wind energy potential and documented the location of numerous species we considered within this analysis. Additional research on the distribution, status, and migratory patterns of a number of species are needed. In the mean time, we believe that wind energy development should focus first on those lands with the least intrinsic wildlife habitat values, such as cropland or areas significantly fragmented by cropland, before considering other low risk lands identified within the report. We also suggest that as MFWP completes its corridors and connectivity planning over the next year, maps and information we offer here be updated by the most recent information.

Finally, wind energy development will ultimately need to be considered in terms of the cumulative effects. The sum of the parts will most likely be greater than each project considered individually. Wind energy holds great promise for providing clean energy, but it needs to be advanced through a process that ensures the reduction in reliance on fossil fuels does not come at a price that diminishes the overall quality of the environment.

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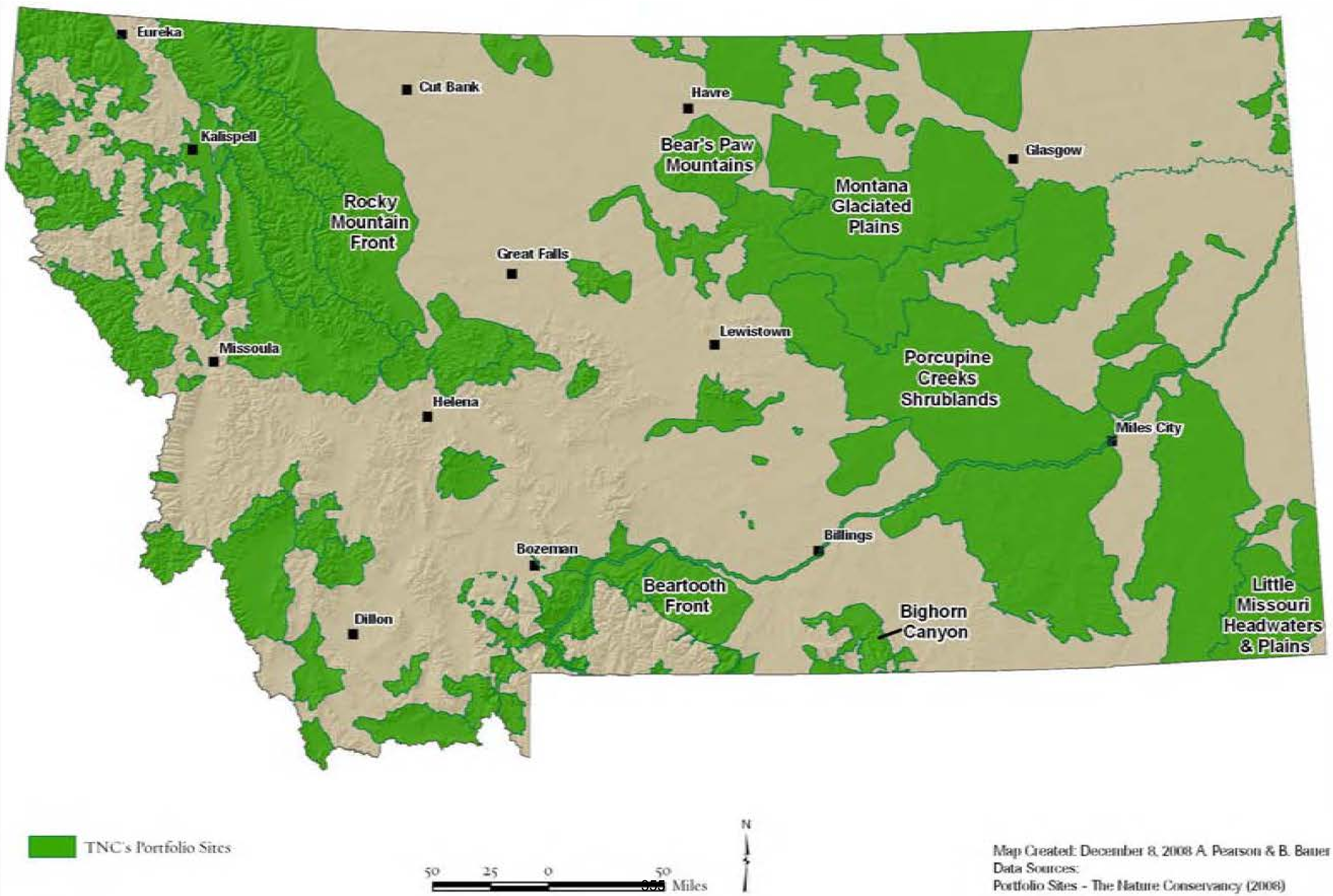
Figure 20. TNC Ecoregional Portfolio Sites within Montana



Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Portfolio Sites - The Nature Conservancy (2008)

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Figure 21. TNC Ecoregional Portfolio Sites and Good-to-Superb Wind Energy Potential

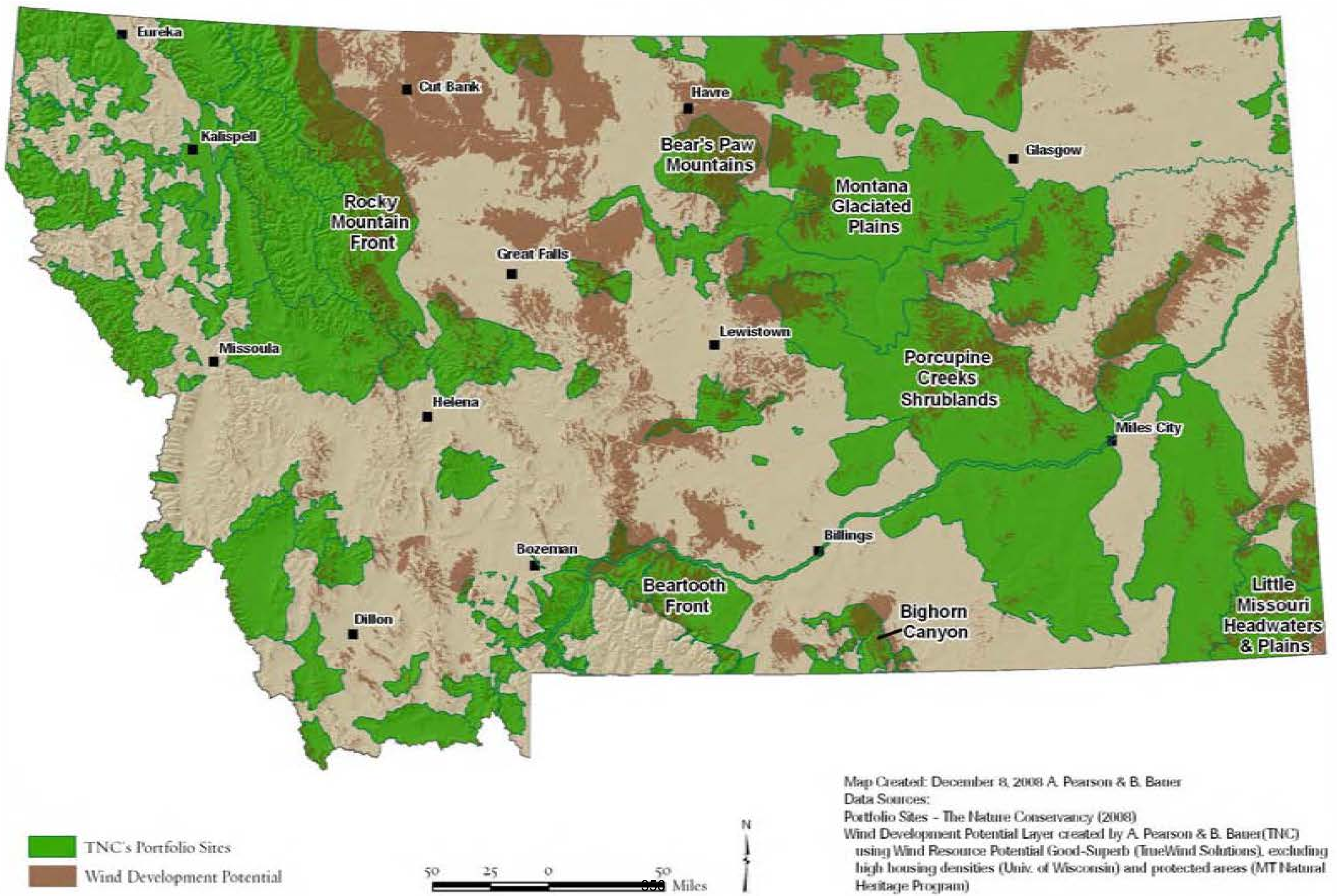

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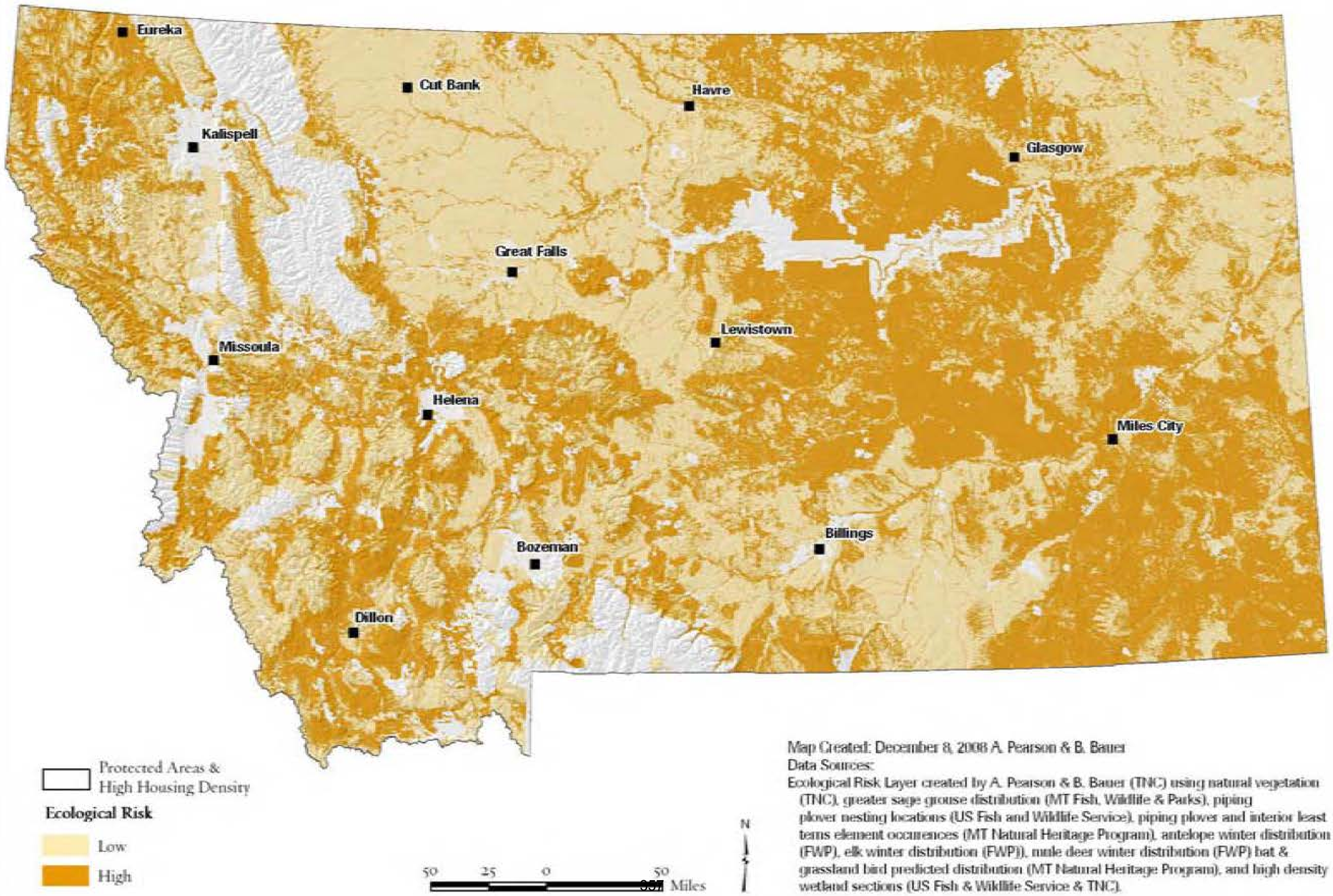
Figure 22. Ecological Risk Assessment for Wind Energy Development in Montana



Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Ecological Risk Layer created by A. Pearson & B. Bauer (TNC) using natural vegetation (TNC), greater sage grouse distribution (MT Fish, Wildlife & Parks), piping plover nesting locations (US Fish and Wildlife Service), piping plover and interior least terns element occurences (MT Natural Heritage Program), antelope winter distribution (FWP), elk winter distribution (FWP)), mule deer winter distribution (FWP) bat & grassland bird predicted distribution (MT Natural Heritage Program), and high density wetland sections (US Fish & Wildlife Service & TNC).

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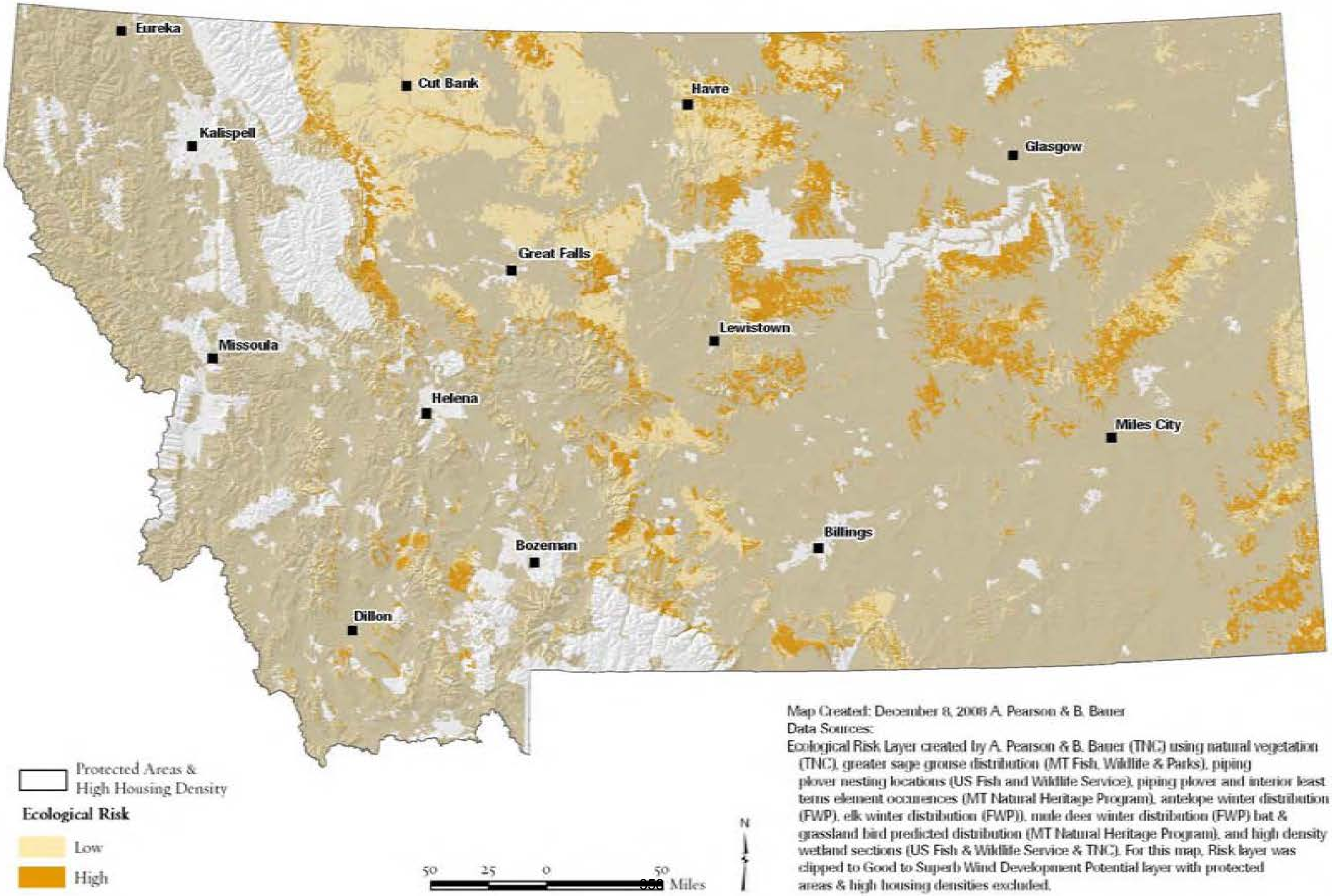
Figure 23. Ecological Risk Assessment for Wind Energy Development within Available Good-to-Superb Wind Energy Potential in Montana



Map Created: December 8, 2008 A. Pearson & B. Bauer
Data Sources:
Ecological Risk Layer created by A. Pearson & B. Bauer (TNC) using natural vegetation (TNC), greater sage grouse distribution (MT Fish, Wildlife & Parks), piping plover nesting locations (US Fish and Wildlife Service), piping plover and interior least terns element occurences (MT Natural Heritage Program), antelope winter distribution (FWP), elk winter distribution (FWP)), mule deer winter distribution (FWP) bat & grassland bird predicted distribution (MT Natural Heritage Program), and high density wetland sections (US Fish & Wildlife Service & TNC). For this map, Risk layer was clipped to Good to Superb Wind Development Potential layer with protected areas & high housing densities excluded.

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Appendix A. Figure Data Sources.

Figure	Layer	Description	Source	Website
1 and 2. Wind Energy Potential	Electric Power Transmission Lines		Ventyx Energy, LLC	
	Wind Resource Potential	Annual average wind resource potential measured at 50 meters above ground level. Wind power density (w/m^2) were broken down into 7 "wind power classes"	True Wind Solutions/ NREL	http://www.windpowermaps.org
3. Lands Excluded	Protected Areas	Conservation Easements, Wilderness Areas, Wildlife Refuges, National Parks, Private Conservation Lands, RNAs, WMAs, ACECs extracted from Stewardship database	MT Natural Heritage Program	http://nhp.nris.mt.gov/
	Housing Densities	2010 predicted Housing density (housing units/km^2)	Roger B. Hammer (Oregon State University), Volker C. Radeloff (University of Wisconsin Madison), and Susan I. Stewart (USDA Forest Service Northern Research Station).	http://silvis.forest.wisc.edu/library/HousingData.asp
4. Low Ecological Risk Areas	Cropland	Fallow, Irrigated, Grazed, Hay, and Continuously Cropped delineations	Montana Department of Revenue (2008)	
	Oil Wells		MT Department of Natural Resource s & Conservation	
5. Intact Natural Habitat	Natural Vegetation	National landcover Dataset classes for forest, shrub/scrub, grassland, sedge & herbaceous (2001)	Multi-Resolution Land Characteristics (MRLC) Consortium	http://www.mrlc.gov/nlcd.php
6 and 7. Sage Grouse Leks	Sage Grouse Leks	Leks with 4 mile buffer	MT Fish, Wildlife & Parks	http://fwp.mt.gov/doingBusiness/reference/gisData/default.html
8 and 9. Grassland Bird Abundance	Grassland Bird Distribution	High densities extracted from predicted distribution models and summed for 12 birds	MT Natural Heritage Program & MT Fish, Wildlife & Parks	

10 and 11. Plover & Tern	Piping Plover	Nesting locations with 1 mile buffer	US Fish & Wildlife Service	
	Interior Least Tern	element occurrence data with 1 mile buffer	MT Natural Heritage Program	http://nhp.nris.mt.gov/
12 and 13. Wetland Densities	High Wetland Densities	Density layer created using National Wetland Inventory polygons and summed by section	US Fish & Wildlife Service	
14 and 15. Bat Abundance	Bat Distribution	Used high densities from predicted distribution models for all bats in Montana, summed all bats together	MT Natural Heritage Program	http://nhp.nris.mt.gov/
16 and 17. Grizzly Bear Habitat	Grizzly Bear Cumulative Effects Model	Habitat Values 6+ from Spring Cumulative Effects Model (2003)	US Forest Service & CEM Working Group	
18 and 19. Mule Deer, Antelope & Elk	Mule Deer Distribution	Winter Range	MT Fish, Wildlife & Parks	http://fwp.mt.gov/doingBusiness/reference/gisData/default.html
	Pronghorn Antelope Distribution	Winter Range	MT Fish, Wildlife & Parks	http://fwp.mt.gov/doingBusiness/reference/gisData/default.html
	Elk Distribution	Winter Range	MT Fish, Wildlife & Parks	http://fwp.mt.gov/doingBusiness/reference/gisData/default.html
20. TNC Ecoregional Portfolio Sites	Portfolio Sites	Priority landscapes for conservation identified in TNC's ecoregional planning process (2008)	The Nature Conservancy	
21. Wind Development Potential	Wind Development Potential	created by TNC using Wind Resource Potential and excluding protected areas & high housing densities		
22 and 23. Ecological Risk	Ecological Risk	summed raster created by TNC using intact vegetation, sage grouse, piping plover, interior least tern, antelope, mule deer, elk, bat, grassland bird, and high density wetland data		

Appendix B

Brief: Grassland bird and bat presence and abundance at select locations in Montana with high wind-power development potential

Susan Lenard
Montana Natural Heritage Program
December 2008

Introduction

This appendix documents bird and bat species presence in areas identified as high potential for wind-power development in Montana. This project was conducted to contribute to current knowledge of avian and bat species distribution to identify potential impact of wind development activities. Because both birds and bats use flight as a means of migration and foraging, the potential impact to these organisms extends beyond simple displacement resulting from wind-farm construction and operation. Wind turbines have the potential to kill numerous species, especially in migratory corridors and areas of high habitat quality. Additionally, a number of bird and bat species documented in these areas are of high conservation concern, a result of widespread and consistent declines across their ranges.

Methods

Polygons were drawn around high wind-power areas in the following regions: Wibaux to Ekalaka (Baker); Big Sheep-Little Sheep; Rapelje to Ryegate; north side of the Bears Paw; and the Kevin Rim area (Appendix Figure 1). Bird surveys within these areas were stratified spatially by random selection of 1:24,000 scale USGS quadrangle maps. Within each randomly selected quad map, the observer was allowed to choose a road intersection at which to start a route and the route to follow within the selected quad map. Flexibility to choose the location of the route on the ground was necessary as the conditions of the roads were not known prior to the survey. Paved roads were eliminated as were all roads that appeared impassable on NAIP imagery and/or in the Montana Gazetteer.

On each route, the first point was selected no less than 400 meters from the selected intersection, with subsequent points placed at 0.5 mile intervals along the route. Ten points were surveyed per route resulting in a total transect length of at least 4.5 miles. In order to maximize the time for point counts in the morning, one observer noted it was necessary to conduct all work relating to recording the points (GPS), field sketching and/or photographing, and recording associated vegetation (macro vegetation and dominant plant species) at least one day prior to the point count. Provided all physical site characteristics were recorded prior to the count morning, three transect routes could be accomplished in one morning, otherwise, only two transect routes were completed. GPS coordinates were taken either at the time the point counts were performed or when the vegetation measurements were taken, whichever came first.

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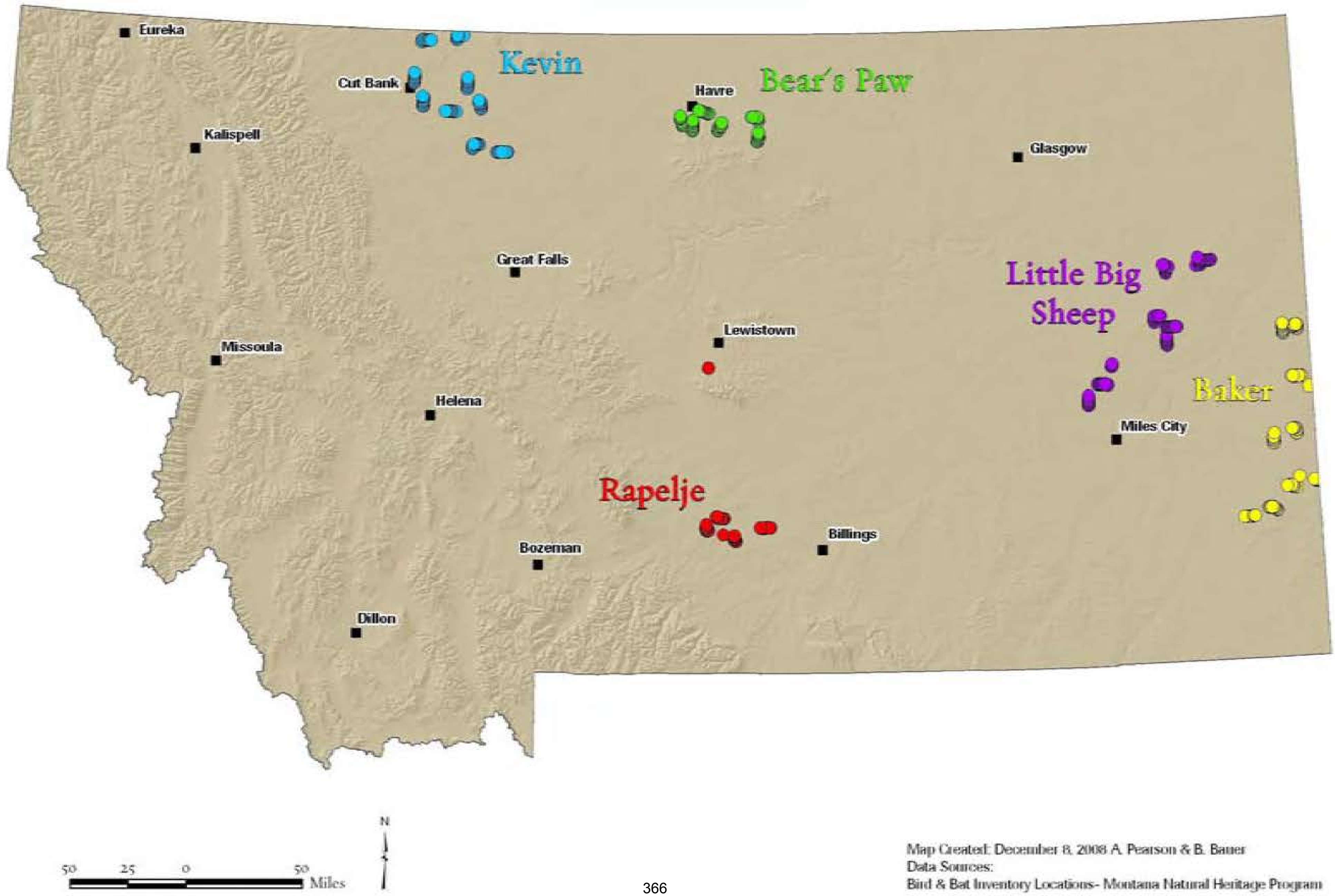
Appendix Figure 1. MT Natural Heritage Program Bird & Bat Inventory Locations



Bat surveys consisted of deploying acoustic recording devices within the identified polygons. While sampling for bats was conducted via road, wetlands and other water sources were targeted, so bat surveys were not tied to the same bird survey routes. Acoustic recording devices (consisting of a Pettersson Ultrasound Detector D 240x, and a MP3 recording device) were placed in a waterproof container and secured on a 5 foot piece of conduit which was placed adjacent to an open water area or beneath a potential roof site (bridge or overpass). The recording device was turned on shortly before dusk to eliminate extraneous daytime noise while still detecting the first emerging bats of the evening. Calls were downloaded each morning at each site, translated to wave files, and subsequently analyzed using SonoBat v2.6 software and the acoustic key developed by Szewczak and Weller (2006).

Point Count Protocol

Point counts were conducted between 7 June and 30 June, 2008 by three individuals. All point counts were five minutes in duration and were conducted between 5:30 am and 10:00 am. Counts were not conducted if continuous rain and high wind were present. All birds detected visually and/or aurally within a 100-meter radius circle from the fixed transect point were recorded with each individual species documented with the appropriate 4-letter AOU code and abundance noted. Birds outside of the 100-meter circle were also recorded, but noted as outside the point count circle.

Vegetation Measurement Protocol

Vegetation measurements were recorded at all points along each transect and consisted of 5 categories of cover type (grass, bare, shrub, water, and wet meadow) for which percentages were assigned. The dominant species within the 100-meter count circle were also recorded.

Results and Discussion

Bird Surveys

Three hundred fifty-nine point counts were conducted along 39 transects resulting in 1,917 recorded bird observations for 92 species of birds. Thirty-three of the 39 transects consisted of ten points each, while six transects conducted consisted of less than ten points due to time or wind constraints. The data derived from these points were added to the Montana Bird Distribution Database housed at the Montana Natural Heritage Program. All data contained in the database that fell within these polygons were summarized collectively and are listed in the tables below (see tables 1-6). [*The column labeled Number of Species Breeding consists of records for which there was direct or indirect evidence of breeding. The Species of Concern list includes Species of Concern as well as Potential Species of Concern as indicated by PSOC*].

Table 1. Bird species overview for wind power analysis areas

Wind Polygon	Number of Documented Species	Number of Species Breeding	Number of Species of Concern
Kevin	153	114	28
Bear's Paw	195	146	40
Little Big Sheep	211	135	41
Baker	154	129	37
Rapelje	77	47	14

Table 2. Kevin Area – List of documented bird species with a count of 10 or more.

Common Name	Record Count	S Rank	Breeding	SOC
Horned Lark	577	S5	Yes	
Vesper Sparrow	336	S5B	Yes	
Savannah Sparrow	264	S5B	Yes	
Western Meadowlark	197	S5B	Yes	
Ferruginous Hawk	173	S3B	Yes	SOC
Red-winged Blackbird	137	S5B	Yes	
Brewer's Blackbird	107	S5B	Yes	
Brown-headed Cowbird	100	S5B	Yes	
Chestnut-collared Longspur	92	S3B	Yes	SOC
House Sparrow	76	SNA	Yes	
Gadwall	73	S5B	Yes	
Mallard	72	S5	Yes	
Killdeer	66	S5B	Yes	
Rock Pigeon	65	SNA	Yes	
European Starling	63	SNA	Yes	
Mourning Dove	59	S5B	Yes	
Swainson's Hawk	58	S3B	Yes	SOC
Northern Harrier	56	S4B	Yes	
Long-billed Curlew	53	S2B	Yes	SOC
McCown's Longspur	53	S2B	Yes	SOC
Eastern Kingbird	43	S5B	Yes	
American Robin	43	S5B	Yes	
Willet	41	S5B	Yes	
American Avocet	37	S4B	Yes	
Northern Shoveler	36	S5B	Yes	
Ring-necked Pheasant	36	SNA	Yes	
American Crow	36	S5B	Yes	
Northern Pintail	34	S5B	Yes	
Clay-colored Sparrow	34	S4B	Yes	
Wilson's Phalarope	33	S4B	Yes	
Marbled Godwit	32	S4B	Yes	

Black-billed Magpie	32	S5	Yes	
Blue-winged Teal	31	S5B	Yes	
American Wigeon	31	S5B	Yes	
Barn Swallow	31	S5B	Yes	
Red-tailed Hawk	30	S5B	Yes	
Ring-billed Gull	29	S5B	Yes	
Western Kingbird	29	S5B	Yes	
Say's Phoebe	27	S5B	Yes	
Yellow-headed Blackbird	26	S5B	Yes	
Golden Eagle	25	S4	Yes	PSOC
California Gull	25	S5B	Yes	
American Coot	22	S5B	Yes	
Cliff Swallow	19	S5B	Yes	
Eared Grebe	18	S5B	Yes	
Cinnamon Teal	18	S5B	Yes	
Gray Partridge	18	SNA	Yes	
Canada Goose	17	S5B	Yes	
Lesser Scaup	17	S5B	Yes	
Loggerhead Shrike	15	S3B	Yes	SOC
Redhead	14	S5B	Yes	
Yellow Warbler	14	S5B	Yes	
Sora	12	S5B	Yes	
Spotted Sandpiper	11	S5B	Yes	
Wilson's Snipe	11	S5	Yes	
Prairie Falcon	10	S4	Yes	

Table 3. Bear's Paw – List of all documented bird species with a count of 10 or more.

Common Name	Record Count	S Rank	Breeding	SOC
Western Meadowlark	93	S5B	Yes	
Vesper Sparrow	63	S5B	Yes	
Horned Lark	56	S5	Yes	
Ring-necked Pheasant	38	SNA	Yes	
Mourning Dove	24	S5B	Yes	
Brewer's Blackbird	23	S5B	Yes	
American Robin	18	S5B	Yes	
Sprague's Pipit	15	S2B	Yes	SOC
Northern Harrier	14	S4B	Yes	
Killdeer	14	S5B	Yes	
Brown-headed Cowbird	13	S5B	Yes	
Long-billed Curlew	12	S2B	Yes	SOC
Eastern Kingbird	12	S5B	Yes	
Clay-colored Sparrow	12	S4B	Yes	
Red-winged Blackbird	12	S5B	Yes	
Mallard	10	S5	Yes	

Table 4. Little Big Sheep Area – List of documented bird species with a count of 10 or more.

Common Name	Record Count	S Rank	Breeding	SOC
Western Meadowlark	102	S5B	Yes	
Horned Lark	82	S5	Yes	
Grasshopper Sparrow	61	S3B	Yes	SOC
Greater Sage-Grouse	51	S2	Yes	SOC
Vesper Sparrow	48	S5B	Yes	
Lark Bunting	46	S3B	Yes	SOC
Brown-headed Cowbird	42	S5B	Yes	
Mourning Dove	37	S5B	Yes	
Chestnut-collared Longspur	33	S3B	Yes	SOC
Eastern Kingbird	25	S5B	Yes	
Brewer's Blackbird	25	S5B	Yes	
Northern Harrier	23	S4B	Yes	
Ring-necked Pheasant	23	SNA	Yes	
Western Kingbird	23	S5B	Yes	
Sharp-tailed Grouse	22	S4	Yes	
Loggerhead Shrike	22	S3B	Yes	SOC
Lark Sparrow	22	S5B	Yes	
Red-winged Blackbird	22	S5B	Yes	
Killdeer	20	S5B	Yes	
American Robin	19	S5B	Yes	
Red-tailed Hawk	18	S5B	Yes	
Yellow Warbler	18	S5B	Yes	
Savannah Sparrow	18	S5B	Yes	
Mallard	17	S5	Yes	
Barn Swallow	17	S5B	Yes	
Sprague's Pipit	16	S2B	Yes	SOC
Brown Thrasher	15	S5B	Yes	
Baird's Sparrow	15	S2B	Yes	SOC
Common Grackle	14	S5B	Yes	
European Starling	13	SNA	Yes	
Brewer's Sparrow	13	S2B	Yes	SOC
Great Horned Owl	12	S5	Yes	
House Wren	12	S5B	Yes	
Blue-winged Teal	11	S5B	Yes	
Gadwall	11	S5B	Yes	
American Kestrel	11	S5B	Yes	
Rock Pigeon	11	SNA	Yes	
House Sparrow	11	SNA	Yes	
Long-billed Curlew	10	S2B	Yes	SOC

Table 5. Baker Area – List of documented bird species with a count of 10 or more.

Common Name	Record Count	S Rank	Breeding	SOC
Western Meadowlark	389	S5B	Yes	
Lark Bunting	234	S3B	Yes	SOC
Mourning Dove	194	S5B	Yes	
Brown-headed Cowbird	190	S5B	Yes	
Horned Lark	183	S5	Yes	
American Robin	128	S5B	Yes	
Red-winged Blackbird	125	S5B	Yes	
House Wren	120	S5B	Yes	
Grasshopper Sparrow	106	S3B	Yes	SOC
Chipping Sparrow	98	S5B	Yes	
Eastern Kingbird	74	S5B	Yes	
Myrtle Warbler	65	S5B	Yes	
Red-breasted Nuthatch	64	S5	Yes	
Greater Sage-Grouse	52	S2	Yes	SOC
Ovenbird	52	S3S4B	Yes	PSOC
Dark-eyed Junco	49	S5B	Yes	
Black-capped Chickadee	42	S5	Yes	
Savannah Sparrow	42	S5B	Yes	
Western Kingbird	41	S5B	Yes	
Yellow Warbler	41	S5B	Yes	
Vesper Sparrow	41	S5B	Yes	
Killdeer	40	S5B	Yes	
Brewer's Blackbird	40	S5B	Yes	
Bobolink	39	S2B	Yes	SOC
Western Tanager	37	S5B	Yes	
Red Crossbill	34	S5	Yes	
Loggerhead Shrike	32	S3B	Yes	SOC
Chestnut-collared Longspur	32	S3B	Yes	SOC
White-breasted Nuthatch	30	S4	Yes	
Cliff Swallow	28	S5B	Yes	
Barn Swallow	28	S5B	Yes	
Hairy Woodpecker	27	S5	Yes	
American Goldfinch	27	S5B	Yes	
Mallard	25	S5	Yes	
Ring-necked Pheasant	25	SNA	Yes	
Western Wood-Pewee	25	S5B	Yes	
Spotted Towhee	25	S5B	Yes	
Baird's Sparrow	24	S2B	Yes	SOC

Northern Harrier	23	S4B	Yes	
Common Grackle	23	S5B	Yes	
Red-headed Woodpecker	22	S3B	Yes	SOC
Say's Phoebe	22	S5B	Yes	
European Starling	21	SNA	Yes	
Mountain Bluebird	19	S5B	Yes	
Dickcissel	19	S1S2B	Yes	SOC
Ferruginous Hawk	18	S3B	Yes	SOC
Red-tailed Hawk	17	S5B	Yes	
House Sparrow	17	SNA	Yes	
Blue-winged Teal	16	S5B	Yes	
American Kestrel	16	S5B	Yes	
Swainson's Hawk	14	S3B	Yes	SOC
Brown Thrasher	14	S5B	Yes	
Northern Flicker	13	S5	Yes	
American Crow	13	S5B	Yes	
Townsend's Solitaire	12	S5	Yes	
Wild Turkey	11	SNA	Yes	
Wilson's Phalarope	11	S4B	Yes	
White-throated Swift	11	S5B	Yes	
Northern Flicker (Red-shafted)	11	SNRB	Yes	
Yellow-rumped Warbler	11	S5B	Yes	
Common Yellowthroat	11	S5B	Yes	
Field Sparrow	11	S4B	Yes	
Lark Sparrow	11	S5B	Yes	
Turkey Vulture	10	S4B	Yes	
Sharp-tailed Grouse (Plains)	10	S4		
Least Flycatcher	10	S5B	Yes	
Black-headed Grosbeak	10	S5B	Yes	

Table 6. Rapelje Area – List of documented bird species with a count of 10 or more.

Common Name	Record Count	S Rank	Breeding	SOC
Western Meadowlark	123	S5B	Yes	
Vesper Sparrow	109	S5B	Yes	
Horned Lark	82	S5	Yes	
McCown's Longspur	27	S2B	Yes	SOC
Mourning Dove	26	S5B	Yes	
Long-billed Curlew	25	S2B	Yes	SOC
Lark Bunting	25	S3B	Yes	SOC
Brown-headed Cowbird	22	S5B	Yes	
Brewer's Blackbird	21	S5B	Yes	
Savannah Sparrow	18	S5B	Yes	
American Robin	13	S5B	Yes	
European Starling	11	SNA	Yes	
Upland Sandpiper	10	S4B	Yes	

Bat Surveys

Sixty-two acoustic bat surveys were conducted across the five areas of interest. Over 6,600 calls were recorded and analyzed resulting in 153 new bat observations across the sites. Since an individual bat can make multiple calls over the course of a recorded survey, the data only infers relative activity and can not be used to infer overall abundance. Multiple calls of each species at each site are recorded in the Heritage Program's Point Observation Database (POD) as one observation. Sonograms that were suggestive of a particular species, but did not meet all of the definitive characteristics in Szweczak and Weller (2006) were classified as probable. These data were not put into the database, but are considered separately as tentative identifications of the species in these areas. All data from POD (a total of 173 bat acoustic identifications for the analysis areas) were used to generate Table 7 (below).

Table 7. Bat Species Observations in wind power analysis areas

Wind Polygon	Common Name	Number of Locations Documented	S Rank	SOC
Kevin				
	Little Brown Myotis	12	S4	
	Silver-haired Bat	9	S3S4	PSOC
	Hoary Bat	5	S3	SOC
	Western Small-footed Myotis	3	S4	
	Big Brown Bat	1	S4	
	Long-legged Myotis (probable)	(2)	S4	

Bears Paw				
	Little Brown Myotis	8	S4	
	Silver-haired Bat	7	S3S4	PSOC
	Hoary Bat	7	S3	SOC
	Western Small-footed Myotis	5	S4	
	Long-eared Myotis	2	S4	
	Fringed Myotis	1	S3	SOC
	Big Brown Bat	1	S4	
	Long-legged Myotis (probable)	(4)	S4	
Little Big Sheep				
	Hoary Bat	10	S3	SOC
	Silver-haired Bat	7	S3S4	PSOC
	Little Brown Myotis	5	S4	
	Long-eared Myotis	3	S4	
	Big Brown Bat	2	S4	
	Fringed Myotis	1	S3	SOC
	Long-legged Myotis	1	S4	
	Spotted Bat	1	S2	SOC
Baker				
	Little Brown Myotis	12	S4	
	Silver-haired Bat	11	S3S4	PSOC
	Hoary Bat	10	S3	SOC
	Long-eared Myotis	6	S4	
	Fringed Myotis	4	S3	SOC
	Big Brown Bat	4	S4	
	Long-legged Myotis	3	S4	
	Western Small-footed Myotis	3	S4	
	Townsend's Big-eared Bat	1	S2	SOC
	Long-legged Myotis (probable)	(10)	S4	
Rapelje				
	Long-eared Myotis	6	S4	
	Silver-haired Bat	6	S3S4	PSOC
	Hoary Bat	5	S3	SOC
	Western Small-footed Myotis	4	S4	
	Big Brown Bat	3	S4	
	Little Brown Myotis	2	S4	
	Fringed Myotis	2	S3	SOC
	Long-legged Myotis (probable)	(7)	S4	

Need for Additional Surveys

While survey work in 2008 contributed greatly to information on the distribution of avian and bat species in these selected areas, the data in no way suggests the information is a complete inventory of species found in these regions. Further surveys are needed, especially in specific locations without survey effort. Also, surveys during other times of the year, especially during migratory periods, will provide a more comprehensive picture of the full complement of species within the areas assessed during this project.

Oregon's High Desert and Wind Energy

Opportunities and Strategies for Responsible Development

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May 2009

Prepared by:

Oregon Natural Desert Association

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Endorsed by:

Audubon Society of Portland
Defenders of Wildlife
Hells Canyon Preservation Council
Oregon Chapter Sierra Club
Western Environmental Law Center
WildEarth Guardians

Oregon Natural Desert Association (ONDA) is a nonprofit conservation organization that exists to protect, defend, and restore Oregon's native desert ecosystems for current and future generations.

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Acknowledgments

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Executive Summary

Oregon's high desert has world-class wildlife and wildland values that deserve protection. Likewise, the region has outstanding wind power resources that could be developed as part of state and national efforts to create energy independence and develop clean sources of renewable energy. Oregonians have the opportunity to develop wind energy responsibly. The key to successful development will be siting wind power strategically in areas suitable for wind power facilities after taking into account other valuable resources in those areas. As interest in constructing utility-scale wind power facilities increases, siting decisions that allow wind power to be developed in a way that protects special landscapes and sensitive wildlife will mutually benefit wind power companies, government entities, local communities, and the larger public.

This report provides an initial analysis of wildlife habitats and landscapes sensitive to wind developments throughout Oregon's high desert. Some of these lands and species are sufficiently sensitive or unique to require the exclusion of wind energy development altogether, while other categories would permit wind energy development if certain best practices are implemented. By overlaying wind resource potential with these other natural values, a picture emerges showing where wind power development will have the least social conflict and environmental impact.

Considerations for Wildlife

Many types of wildlife are known or expected to be sensitive to industrial wind power development. Because of the propensity for wind turbines to kill birds through collisions with spinning blades and bats from air pressure trauma is established, it is preferable to site turbines in areas where there is low concentration of bird and bat activity. Roads, powerlines and other developments associated with wind projects can also lead to habitat fragmentation and the displacement of wildlife from preferred habitats, particularly for sensitive species such as Greater sage-grouse (*Centrocercus urophasianus*).

Potential impacts on big game in areas such as winter range have been suggested by studies examining ungulate reactions to various types of infrastructure and disturbance similar to what may be encountered during development and/or operation of a wind development site. Potential impacts on small mammals remain poorly understood and more study is needed to reach definitive conclusions. Overhead powerlines and other infrastructure can lead to an increase in perching and nesting sites for predatory birds, significantly increasing the predation risk to small mammals and birds in the area.

It is important to consider that existing traditional land protection categories may not be sufficient to protect critical wildlife populations. It is important also to consider impacts that occur in the airspace. Placement of turbines in low value habitats and developed landscapes can cause significant impacts if the airspace is used by high concentrations of birds or bats. It is critical to consider both the terrestrial habitat and wildlife usage of the airspace.

Sensitive Landscapes

Oregon is known throughout the world for its iconic western landscapes. Many of these, like national parks, wilderness areas, and wilderness study areas, have been placed off-limits to industrial activities by federal law or regulation. Others, such as roadless areas and Areas of Critical Environmental Concern, have limited protective designations which would tend to hinder the timely development of wind projects and might preclude development in some cases. There is a third category of lands, Citizen Proposed Wilderness, which may lack formal protection at present but have a high public profile, strong scenic values, and sensitive wildlife habitat and therefore development would potentially face stiff public opposition.

Historical and cultural sites and trails are typically protected by federal law which requires that the sites as well as their historic settings be protected. Overall, open spaces in Oregon are highly valued, which means that projects that do not impair prominent viewsheds are less likely to face opposition. By steering wind projects away from lands where industrial development would be controversial, wind developers can reap the benefits of maintaining their "green" credentials and achieve a speedier approval process that enjoys strong and broad public support.

Prioritizing Wind Power Development in Oregon

When sensitive resources are overlaid with wind power potential on a map of Oregon, it becomes apparent that some areas are unlikely prospects for wind energy due to low winds or multiple environmental sensitivities, while other areas have strong wind resources according to National Renewable Energy Laboratory (NREL) data and fewer resource conflicts.

For the purposes of this analysis, some lands were treated as "exclusion areas" because legal restrictions associated with state and/or federal law effectively preclude development of these areas. Other areas were treated as "high conflict" areas because of wildlife habitat values, federal designations, and/or citizen proposed wilderness areas that are likely or known to be incompatible with industrial scale wind development. "Moderate conflict" areas included a variety of areas where additional and in some cases extensive mitigation and monitoring would be required as part of any proposed development (see Table 1). For mapping purposes, "moderate conflict" areas were included with "low conflict" areas. Conflict levels within 3 miles on each side of existing transmission lines were reduced one level to acknowledge the potential advantages and benefits of developing projects along pre-existing transmission lines rather than in currently unfragmented habitats.

There are approximately 6.8 million acres of land in the study area that have low or moderate potential for environmental or social conflict, 13.6 million acres with high potential for conflict and 3.8 million acres that are currently excluded from development. As illustrated in Map 1, there are approximately 467,000 acres of low to moderate conflict areas that our analyses show have high wind resource (NREL Class 3 or greater). There are an additional 927,000 acres that have similarly high wind resource but have potentially high natural resource or social conflicts. Approximately 691,000 acres with high wind resource potential are currently excluded from development.

Map 2 outlines currently proposed wind projects and illustrates whether these projects are proposed in high, moderate or low conflict areas. Appendix A includes maps showing the proposed projects on a county-by-county basis.

Table 1. Summary of environmental and social conflicts used in mapping analysis

Exclusion Areas	High Conflict Areas	Moderate Conflict Areas
Wilderness Areas	Sage-grouse leks-3 mile buffer	Sage-grouse leks-5 mile buffer
Wilderness Study Areas	Research Natural Areas	TNC Portfolio Sites
Steens Mountain Cooperative Management and Protection Area (CMPA)	Steens Mountain Geothermal/Mineral Withdrawal Area	State of Oregon Conservation Opportunity Areas
State Scenic Waterways	Citizen Proposed Wilderness	High Desert Trail
State and **National Wildlife Refuges**	Areas of Critical Environmental Concern	Historic Trails
BLM-VRM Class I	BLM-VRM Class II	
National Parks/Monuments	Bighorn Sheep Habitat	
Wild and Scenic Rivers	Sensitive Bat Habitat	
USFS Roadless Areas		

Site-specific research and a growing understanding of wind development impacts may reveal unforeseen impacts in these areas however we encourage developers and permitting authorities to first consider development in these areas. By doing so, Oregon will be able to reach our renewable energy goals while ensuring that Oregon's outstanding landscapes and fully functioning ecosystems are preserved.

In developing wind projects, we also propose the following siting recommendations:

1) Conduct at least two years of pre-development environmental studies using standardized methods which demonstrate the proposed site's comparative limited use by, and importance to, sensitive wildlife and plant species. These studies should pay special attention to breeding and rearing habitat, movement corridors and habitat connectivity.

2) Exclude from wind power siting and transmission line construction consideration the following areas: National Parks, Wildlife Refuges, USFS Roadless Areas, Wilderness,

Wilderness Study Areas, Important Bird Areas and areas within 3 miles of greater sage-grouse leks.

3) Establish support from county government and from municipalities located within 5 miles of a project.

4) Avoid viewshed impacts on historic trails and sites, National Parks, Wilderness, Wild and Scenic Rivers and other high-value recreation areas including the Steens Mountain Cooperative Management and Protection Area and Hart Mountain National Wildlife Refuge.

5) Prioritize potential wind development sites located near existing power transmission infrastructure, final customers, or areas of previously disturbed or converted lands such as agricultural fields.

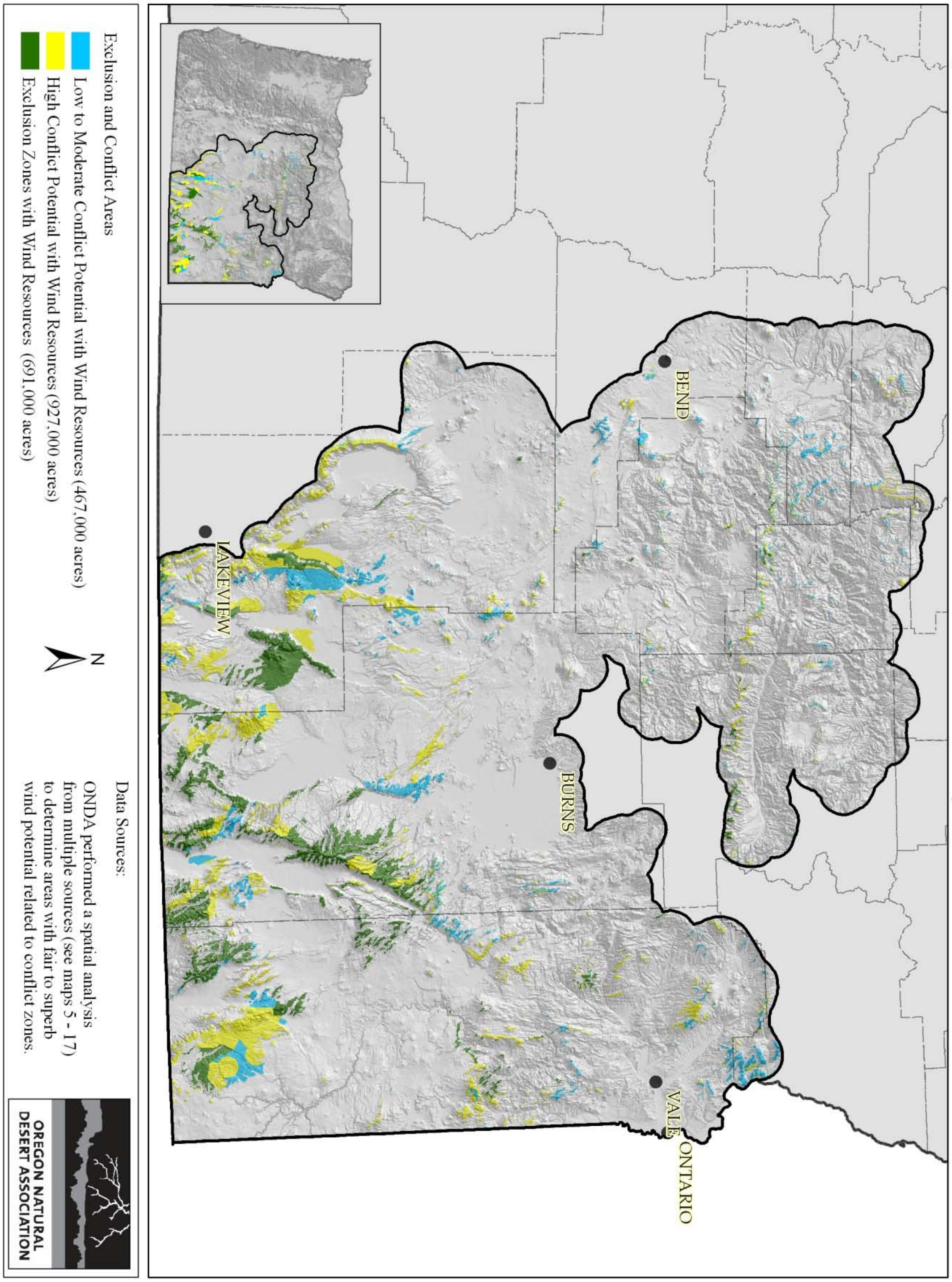
6) Conduct comprehensive evaluations of conditions and resources at potential sites consistent with the Oregon Columbia Plateau Ecoregion Wind Energy Siting and Permitting Guidelines.

7) Prepare studies, development and mitigation plans and conduct the permitting process to ensure protection of natural resources by following the Oregon Energy Facility Siting Council's site certification process or a local process that involves an equivalent level of mandatory and enforceable resource protection standards and that considers cumulative impacts of wind development throughout Oregon's high desert.

Conclusion

Developing wind energy within Oregon's high desert in a way that is sensitive to wildlife and protects important landscapes can be achieved. This report identifies both areas of high development potential and a proposed process for moving forward. We suggest that these areas be considered first for wind development and that within these areas, previously disturbed habitats such as cropland be prioritized. This report is intended to be a work in progress; vulnerable species may have been overlooked during completion of this report and as our understanding of wind development grows, such research should be incorporated into decision-making and planning. Oregon's high desert is an area that is relatively understudied and there are gaps or biases in the report due to data unavailability. We have done our best to draw relevant studies from both Oregon's high desert and beyond to address this insufficiency. This report is not meant to substitute for on-the-ground studies but to provide initial guidance that will be further informed by future research and local studies.

Lastly, as outlined in the report, wind development needs to be considered in terms of cumulative effects. Currently, projects are being approved on an individual basis with no collective evaluation of social and environmental impacts. We are concerned that such an approach could have significant impacts on wildlife and landscape connectivity. We strongly encourage a planned approach to wind development that includes prioritizing development of transmission lines in locations that encourage wind and other renewable energy development in areas with lower social and environmental conflicts. Wind energy promises to play a significant role in providing clean energy and strong job creation in areas that need it most but it must not be done in a way that fails to recognize and address its true costs.


Map 1
Wind Power Resource Analysis
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Exclusion and Conflict Areas
Low to Moderate Conflict Potential with Wind Resources (467,000 acres)
High Conflict Potential with Wind Resources (927,000 acres)
Exclusion Zones with Wind Resources (691,000 acres)
N
Data Sources:
ONDA performed a spatial analysis
from multiple sources (see maps 5 - 17)
to determine areas with fair to superb
wind potential related to conflict zones.
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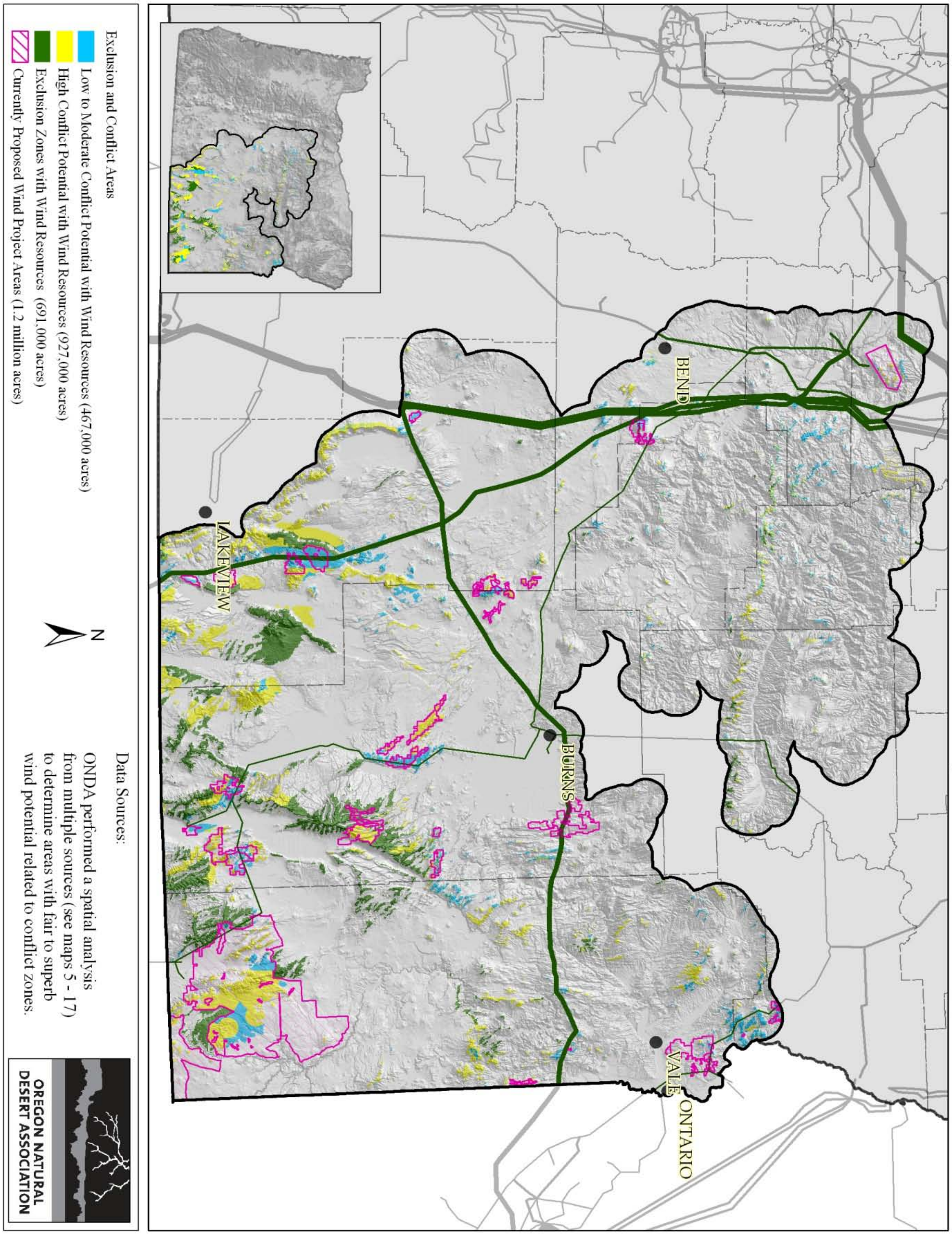
Map 2
Wind Power Resource Analysis
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Exclusion and Conflict Areas
Low to Moderate Conflict Potential with Wind Resources (467,000 acres)
High Conflict Potential with Wind Resources (927,000 acres)
Exclusion Zones with Wind Resources (691,000 acres)
Currently Proposed Wind Project Areas (1.2 million acres)
N
Data Sources:
ONDA performed a spatial analysis from multiple sources (see maps 5 - 17) to determine areas with fair to superb wind potential related to conflict zones.
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Introduction

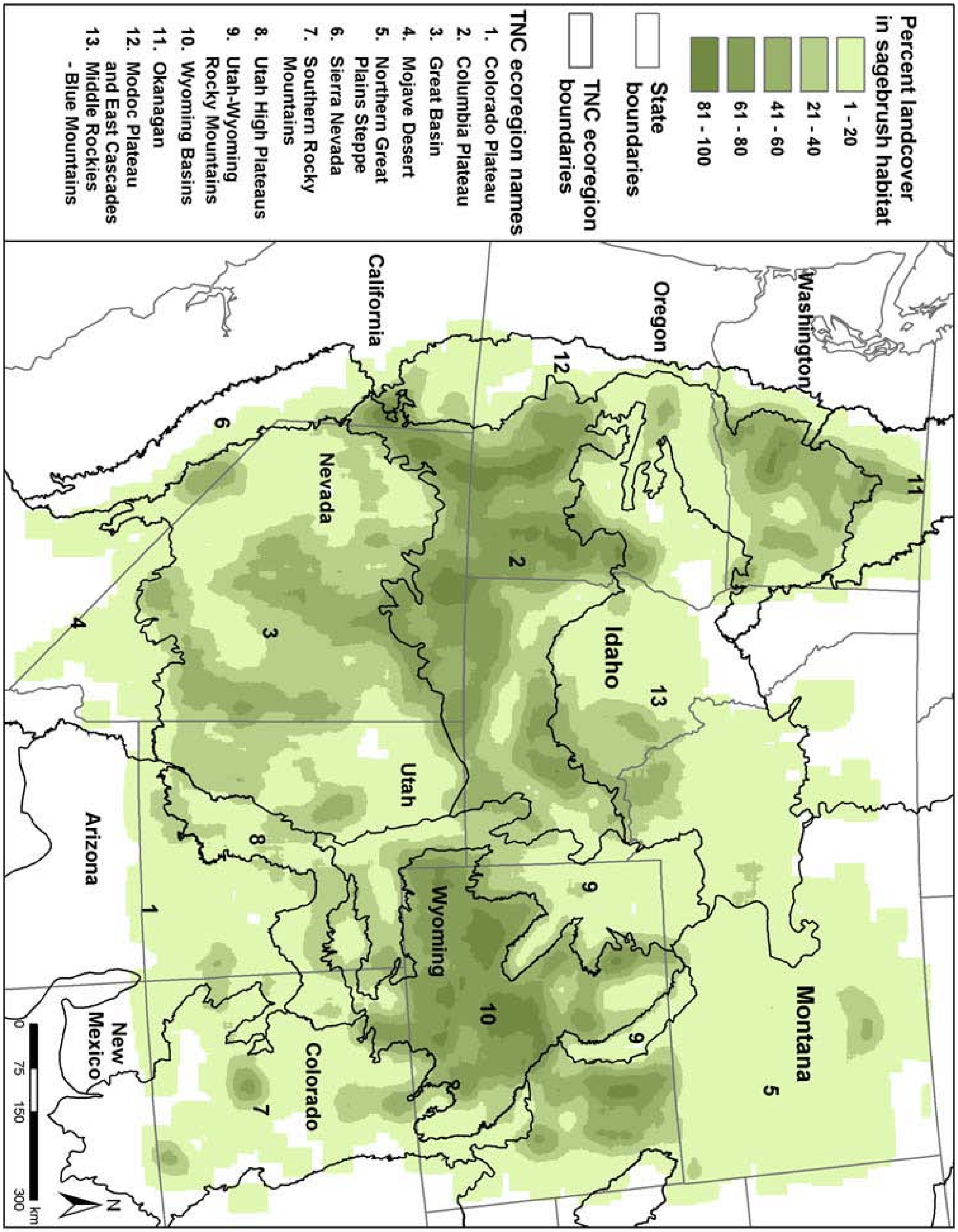
Across Oregon and the country, there is an unprecedented surge in renewable energy development from sources such as wind, solar and geothermal. Proposals for wind development have become particularly common with over a dozen projects proposed in Eastern Oregon during 2008. With the State of Oregon committed to supplying 25 percent of the state's electric power from new renewable sources by 2025 and US Department of Energy's (USDOE) goal of producing 20 percent of US energy production from wind by 2030 (USDOE 2008), proposals for new wind development are likely to continue in Oregon's high desert.

Although wind energy is prominently featured in the nation's quest for green energy, it is important to remember that there are several other sources of green energy that are also potentially available in Oregon's high desert including solar and geothermal. A later report will likewise analyze the potential impacts and benefits from these other potential energy sources. In addition, small-scale energy projects are also becoming more viable and thus may foster future development associated with individual homes and already developed urban areas.

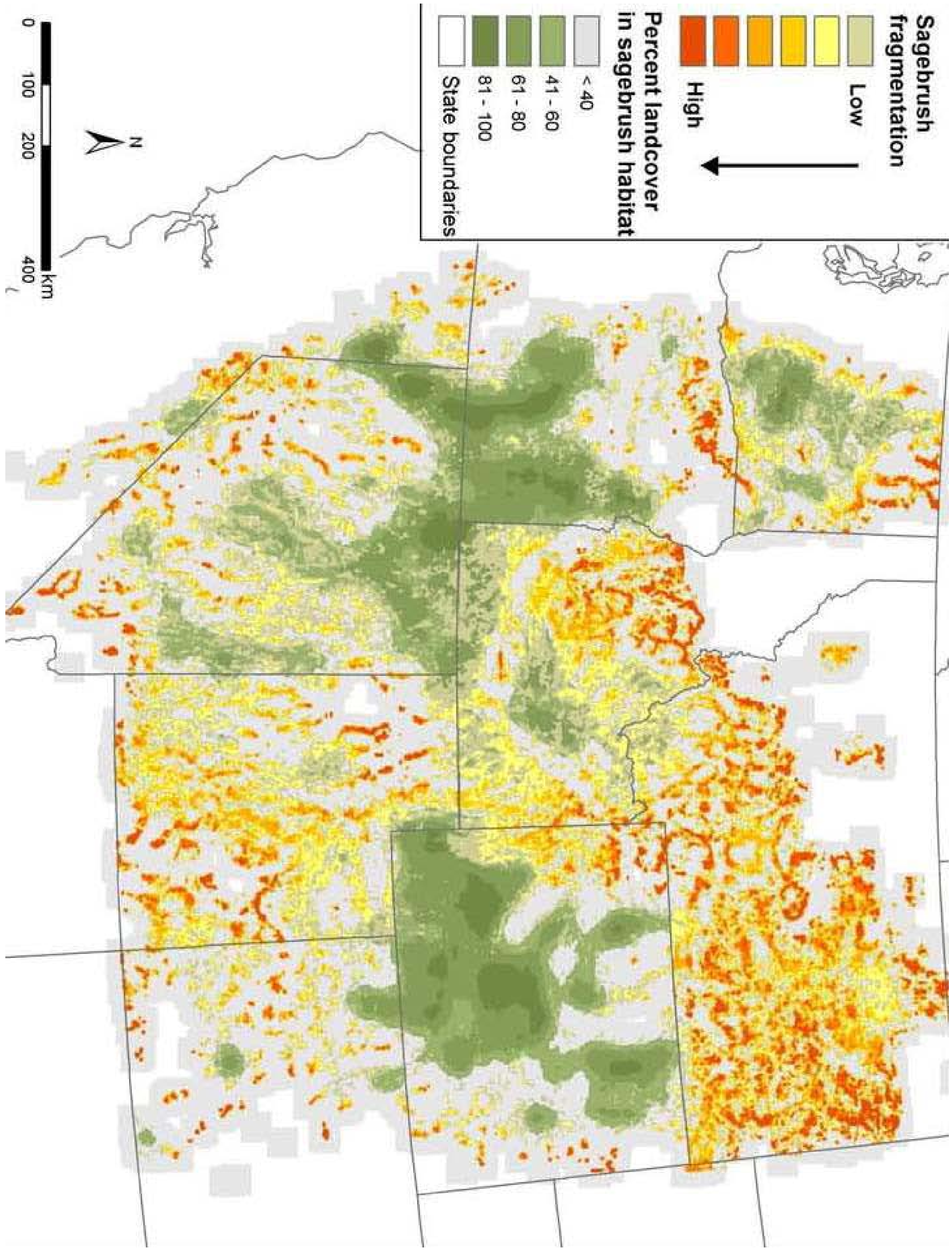
Although Oregon ranks 23rd in wind energy potential among US states, it ranks 8th in current wind capacity among all states with a 438 mW capacity (Wind Today, 2008). Wind potential exists in Oregon's high desert, both on private lands and, on public lands managed by the Bureau of Land Management (BLM). To-date, wind development in the region has been largely confined to wheat fields and other already developed lands. The more recent push for large-scale wind energy development in currently undeveloped areas poses impacts to sensitive wildlife species and iconic landscapes and therefore more potential for public concern.

Photo 1. Wind turbines in Sherman County (C. Miller)

The development of industrial energy generation and new transmission lines in southeast Oregon would likely degrade wildlife habitat, ecological communities, and fragment important areas of the remaining sagebrush steppe ecosystem. Noss et al. (1995) identified the sagebrush steppe as the 3rd most degraded ecosystem of the United States. Another review (Sagebrush Sea, 2007) identified numerous threats to the sagebrush ecosystem including fragmentation by utility corridors and roads. Within the shrub-steppe ecosystem, southeastern Oregon is an area of relatively unfragmented habitat and very high bird and mammal species diversity (Maps 3 and 4). Therefore, the biological value of the region is of national significance.



MAP 3. Distribution of sagebrush (from Knick et al. 2003). Map depicts percent of land cover within 25-km radii of each map cell dominated by tall sagebrush, produced by resampling the base map to a 2.5 km resolution ***[REPRODUCED FROM DOBKIN AND SAUDER 2004:6]***



Map 4. Sagebrush distribution is highly fragmented and much less extensive than large-scale maps suggest. The map depicts the ratio of the percent of land cover containing sagebrush (Map 1) to the amount of perimeter with other habitats. Dark-green areas indicate extensive distribution of sagebrush as the dominant feature in the landscape (area is much larger that perimeter), grading into gray areas (small area, small perimeter), and crossing a threshold at which fragmentation of sagebrush patches (low area, high perimeter) becomes the dominant landscape feature. Small-scale measures of perimeter were estimated by resampling the base map to a 500-m resolution and measuring the proportion of total edge between sagebrush and other habitat patches within 2.5 km of each map cell. ***[REPRODUCED FROM DOBKIN AND SAUDER 2004:7]***

Wind facilities cover a large area and require extensive road systems and transmission corridors. The impacts of wind developments on biodiversity is still largely unknown although a growing number of studies have documented impacts of wind development on wildlife, particularly birds and bats (Kunz et al. 2007, Stewart et al. 2007). These impacts have been caused by:1) destruction and fragmentation of habitat; 2) displacement of species caused by turbines, transmission lines and other associated development; and 3) direct mortality.

Concerns regarding human health disturbances have been raised by people living in the vicinity of wind developments, however, in many cases these concerns have not been substantiated by scientific research. Complaints and testimonies have typically focused on noise, flicker, vibrations, and lighting disturbances created by wind farms (Pedersen and Waye 2004). The impact and range of impact was found by residents to be much more significant than were originally described by developers. Other more acute safety concerns focus have focused on lightening strikes on wind towers, ice thrown from blades, and the growing number of documented cases of collapsing or “exploding” turbines/towers (Galbraith 2008).

To ensure that unnecessary conflict and impacts are avoided, this report outlines an approach to developing wind energy that protects open space and native ecosystems and is an asset to local communities. We believe that the thoughtful siting of wind energy facilities, creation of permitting processes that ensure adequate evaluation and mitigation of impacts, and the adoption of Best Practices can ensure that wind energy development is successful and avoids unnecessary conflicts with other public interests.

The intent of this report is to provide a blueprint for wind power development in Oregon’s high desert by outlining: 1) potential conflicts between wind development and social and environmental values; 2) where wind might be developed while minimizing impacts to other resources; 3) where development shouldn’t be attempted due to the high level of conflicts inherent to a particular site; 4) best practices for wind development; and 5) process guidelines that will ensure that the public is adequately involved in project permitting.

It is our hope that this report will help guide wind power planning on a regional scale so that wind power generation can be expedited and fostered in areas with the least conflict, while ill-advised forays into Oregon’s most sensitive desert landscapes will be prevented. If wind power development is pursued in this manner, controversy and protracted conflicts can be avoided to the mutual benefit of the industry, our lands and wildlife, and the people of Oregon.

Wind Power and the Solution to Global Climate Change

Wind power generation is seen as part of a solution to the problem of global climate change. Global climate change is driven by the production of carbon dioxide (CO_2) and other “greenhouse gases” (IPCC 2007). Global climate change is a serious environmental crisis, causing rising sea levels, disappearance of certain habitats, changes in patterns of droughts and floods, and serious losses in biodiversity worldwide. To the extent that wind power displaces forms of electrical generation that emit greenhouse gases, it can be part of the solution to global climate change.

While the coal industry touts the potential of “clean coal,” all coal-fired electrical generation in the U.S. at the present time is “dirty” from the perspective of carbon dioxide emissions, because there is presently no commercial coal-fired power plant in the United States that is sequestering its carbon dioxide to prevent emissions of CO_2. In 2005, electrical power generation produced 39 percent of all CO_2 emissions in the United States (National Research Council 2007). Demand for electricity continues to escalate in the United States, and the increase in wind power development may not keep pace with the overall increase in demand. As a result, the increase in wind energy may not result in an overall decrease in carbon dioxide and other pollutants due to a projected escalation demand for energy (National Research Council 2007).

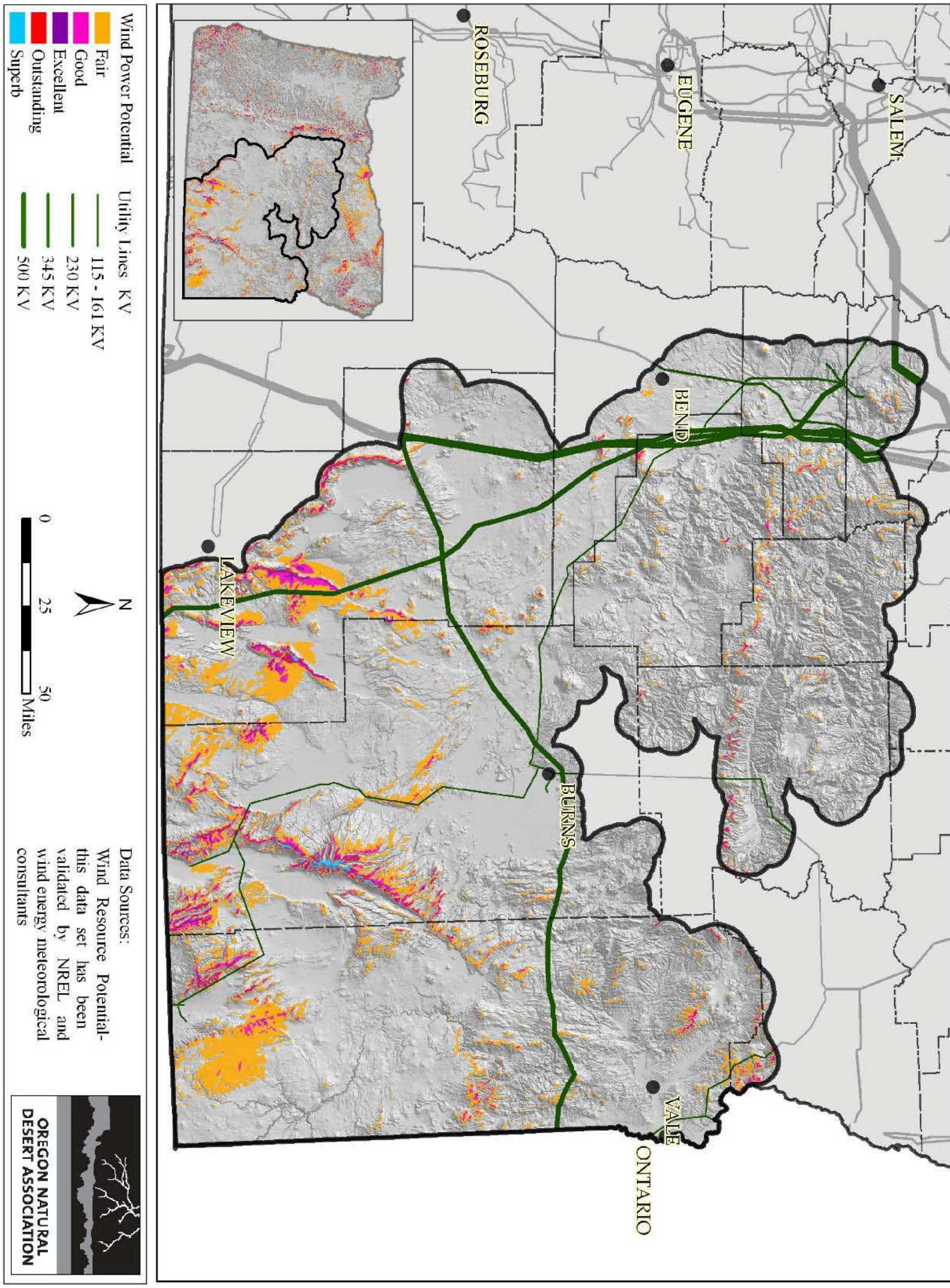
It is clear that it is in the best interests of Americans to replace fossil fuels with clean, sustainable energy sources. It is equally clear that Oregon residents have a strong interest in ensuring that a major increase in industrial wind energy is done intelligently by siting wind power facilities in areas where impacts to sensitive and treasured natural resources will be minimized.

The American Wind Energy Association (2000) projected that if all economically feasible land sites for wind energy development were installed with wind turbines, the resulting generation would supply approximately 20 percent of the nation’s electricity needs. Certainly, not all sites that are economically feasible are suitable for wind power development from an environmental or social perspective, so it is likely that wind energy will ultimately become a somewhat smaller percentage of overall electricity production in the United States. But wind energy does represent a potentially important part of a clean energy future in which it is complemented by a number of other renewable energy sources.

For the purposes of this report, we conducted analyses of likely locations for wind energy development using the National Renewable Energy Lab (NREL) wind power class 3 or higher, since those classes have the greatest potential of generating wind power with large turbines (Map 5). Technological advancements including the development of larger turbines are now allowing the development of areas with lower wind resource value.

The Economic Advantages of Wind Power

In Eastern Oregon, where historically resource extraction-based economies have experienced significant declines, wind power generation creates a potential source of steady income and highly skilled jobs, making it an asset to local communities. For local economies, wind power creates more economic input per kilowatt than either coal or gas-fired electricity generation


Map 5 Wind Power Potential and Electric Transmission Lines
SALEM
EUGENE
ROSEBURG
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Wind Power Potential
Fair
Good
Excellent
Outstanding
Superb
Utility Lines KV
115 - 161 KV
230 KV
345 KV
500 KV
N
0 25 50 Miles
Data Sources:
Wind Resource Potential- this data set has been validated by NREL and wind energy meteorological consultants
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(Tegen 2006). Wind power is a different type of energy industry that promises to employ well paid professionals who will become long-term members of local communities and yield long-lasting and steady streams of income to local economies. Thus, wind power development is much more economically sustainable than oil and gas development. Recent studies have shown that recreation and scenery provided by public lands are essential components of a quality of life that attracts and retains people and their business to western communities (Headwaters, 2008) and therefore development that balances these values with development will ultimately provide more sustainable economies.

A Blueprint for Smart Wind Development

The key to smart and responsible wind development is pairing economically-viable siting choices with methods of development that minimize conflicts between utility-scale wind power projects and sensitive wildlife and landscapes. The potential for wind turbines to kill birds and bats has been documented (Kunz et al. 2007, Kuvlesky et al 2007, Stewart et al. 2007). This potential can be minimized by siting turbine facilities away from areas where birds and bats concentrate their flying activities, such as mating and nesting sites, roosting areas, and migration flyways.

Because wind power facilities are industrial developments, often on a very large scale, they have the potential to fragment habitats and displace sensitive wildlife to other areas. Special consideration must be given in long-term planning to the fact that this fragmentation is cumulative, increasing with future development and concentration of additional sites and associated infrastructure. The wind industry and land and wildlife managers will need to develop an understanding of which species in the region are most affected by wind projects and avoid siting projects in the most sensitive areas.

Finally, there is a social element to where, how fast, and how much wind energy development is appropriate. Wind energy development should avoid the most treasured landscapes and areas, get buy-in from local communities before constructing facilities next door, and moderate the pace and scale of wind development so that the open spaces and untamed character of the Oregon desert landscape are not threatened and citizens are satisfied with the outcomes of development.

This report was developed in part using Geographic Information Systems (GIS) technology to illustrate sensitive resources and areas with the best wind power potential. The accompanying text describes the potential conflicts with wind energy development as well as Best Practices to minimize these conflicts. The analysis is based on available sensitive species data which is not a substitute for site-specific data that will need to be collected at sites prior to development. This report should be viewed as a first draft and will be updated as necessary.

This report is also designed to be a review of the scientific literature on wind power and its impacts, as a resource for industry, planners, and the public. We rely heavily in this report on studies that have been conducted across the nation on impacts of wind energy and the properties of sensitive wildlife in formulating our recommendations. Large-scale wind energy development is a relatively new phenomenon, and we rely on peer-reviewed science whenever it is available and supplement it with unpublished studies and monitoring reports that are more widely available.

Special Landscapes

There are certain special landscapes which, due to their iconic qualities, pristine nature, and biological or recreational values are not compatible with industrial use. Many of these lands have received official designations while others have not yet been officially recognized by federal and state agencies or by Congress. This section will address landscapes that enjoy special designations that preclude wind energy development by law or regulation, or where wind energy development is likely to be incompatible because these areas have been designated for other priorities. Private land inholdings exist within several of the areas described below. Because development of these lands would compromise the ecological integrity of these areas, we likewise recommend that these private lands not be considered for wind development. Viewsheds from these areas should likewise be avoided by siting turbine arrays behind intervening topography. Historic and cultural areas are discussed in a later section.

National Parks, Monuments, Refuges and Conservation Areas

National Park system units including both National Parks and National Monuments are managed under a strong legal mandate which directs the federal government to "protect and preserve" these lands and their natural resources "for the use and enjoyment of the public." National Park units are precluded from industrial development. Wind energy development would not be allowed by law in these units regardless of their wind energy potential. The Newberry Crater National Monument and the three units of the John Day Fossil Beds National Monument are two such federally-designated areas located in eastern Oregon.

Photo 2. Steens Mountain (Bruce Jackson)

Similarly, special management areas, such as the Steens Mountain Cooperative Management and Protection Area (CMPA), were established and are administered by BLM to protect specific resources. Congress passed the Steens Act and created the CMPA in 2000 to protect and restore the "long-term ecological integrity" of Steens Mountain. Utility-scale wind power development is inconsistent with the protection and restoration of the biological integrity of Steens Mountain and because the Steens Act of 2000 prohibits the construction of energy facilities on federal lands within the CMPA and geothermal/mineral withdrawal area. We recommend that the Steens Mountain and similar special management areas be viewed as areas off-limits to wind development.

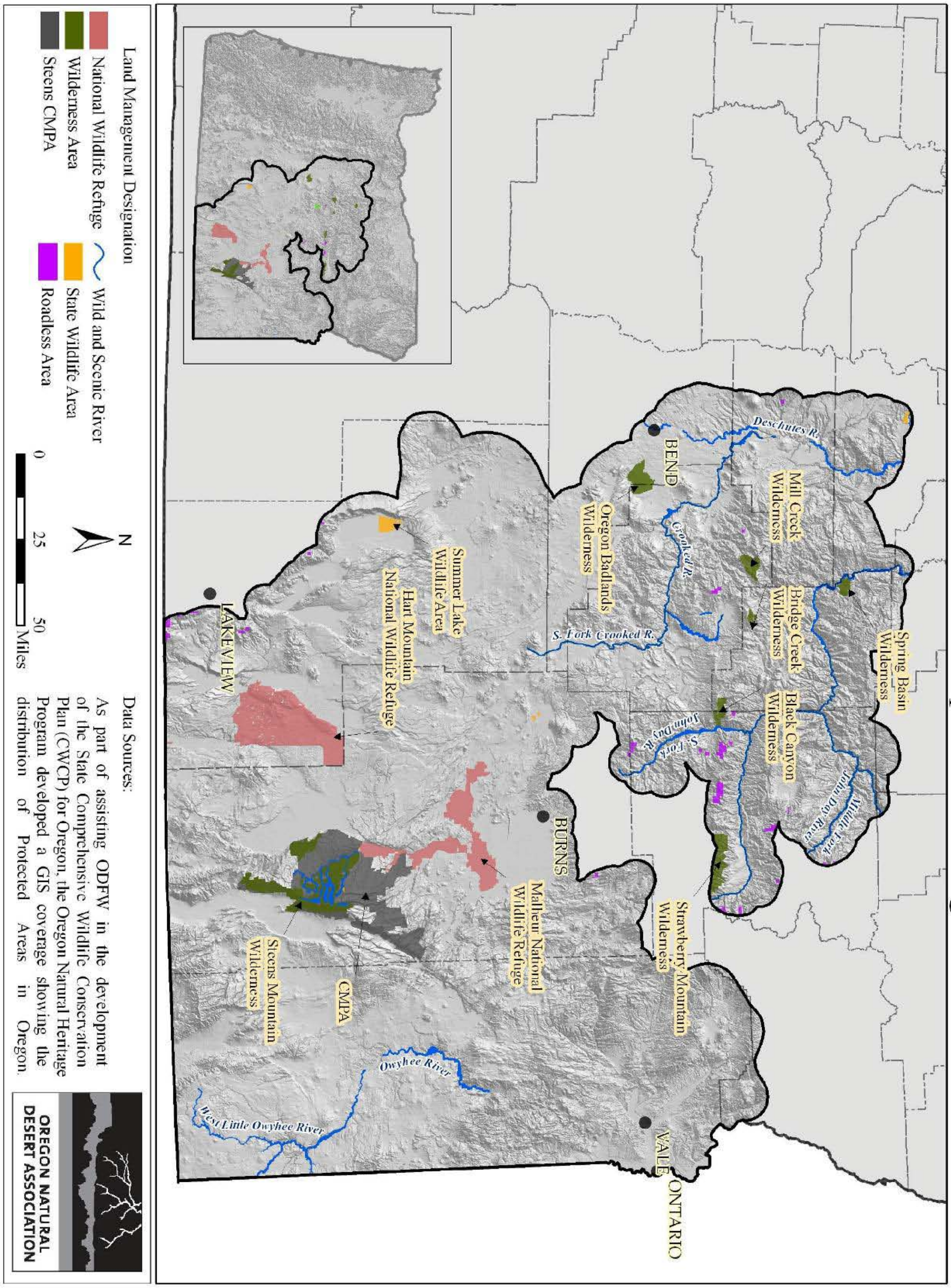
Several wildlife refuges exist in Oregon's high desert including Hart Mountain National Antelope Refuge, Malheur National Wildlife Refuge, and Summer Lake State Wildlife Area. These areas provide critical habitat for shorebird and waterfowl species sensitive to direct impacts from wind turbines and habitat fragmentation. Management for these areas is inconsistent with wind development and they should likewise be considered off-limits to development (Map 6).

Wilderness and Wilderness Study Areas

Some lands in Oregon have been designated by Congress as Wilderness under the 1964 Wilderness Act. By law, wilderness areas are public lands that appear to be affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.

In 1976, the Bureau of Land Management (BLM) was directed by Congress to inventory its lands for wilderness qualities and establish Wilderness Study Areas (WSAs) for congressional consideration under the Federal Land Policy and Management Act. Eighty-one WSAs have been established in Oregon (Map 7). These WSAs are also classified as Visual Resource Management Class I by the BLM, in which the goal is "to preserve the existing character of the landscape" (BLM Handbook H-8410-1).

In addition to the backcountry recreation values present in wilderness, these areas frequently possess important fish and wildlife habitat. For example, Kershner et al. (1997) found that adult density, size, and habitat quality were greater for Colorado River cutthroat trout in wilderness areas compared to adjacent roaded lands. Large predators as well as game animals such as elk are threatened by the disappearance of large, roadless tracts of habitat that serve as security areas. Edge and Marcum (1991) found that elk use was reduced within 1.5 km of roads, except where there was topographic cover. Gratson and Whitman (2000) found that hunter success was higher in roadless areas than in heavily roaded areas, and that closing roads increased hunter success rates. Cole et al. (1997) found that reducing open road densities led to smaller elk home ranges, fewer movements, and higher survival rates. Thus, roadless areas have come to provide important security habitat for elk. In addition, Van Dyke et al. (1986) found that "areas where there is continuing, concentrated human presence or residence are essentially lost to the [mountain] lion population."


Map 6
Federal and State Special Designations
Spring Basin Wilderness
Mill Creek Wilderness
Bridge Creek Wilderness
Black Canyon Wilderness
Oregon Badlands Wilderness
Summer Lake Wildlife Area
Hart Mountain National Wildlife Refuge
Malheur National Wildlife Refuge
Strawberry Mountain Wilderness
CMPA
Steens Mountain Wilderness
BEND
BURNS
LAKEVIEW
VALE
ONTARIO
Deschutes R.
Crooked R.
S. Fork Crooked R.
John Day R.
S. Fork
Middle Fork
John Day River
Owyhee River
West Little Owyhee River
Land Management Designation
National Wildlife Refuge
Wilderness Area
Steens CMPA
Wild and Scenic River
State Wildlife Area
Roadless Area
N
0 25 50 Miles
Data Sources:
As part of assisting ODFW in the development of the State Comprehensive Wildlife Conservation Plan (CWCP) for Oregon, the Oregon Natural Heritage Program developed a GIS coverage showing the distribution of Protected Areas in Oregon.
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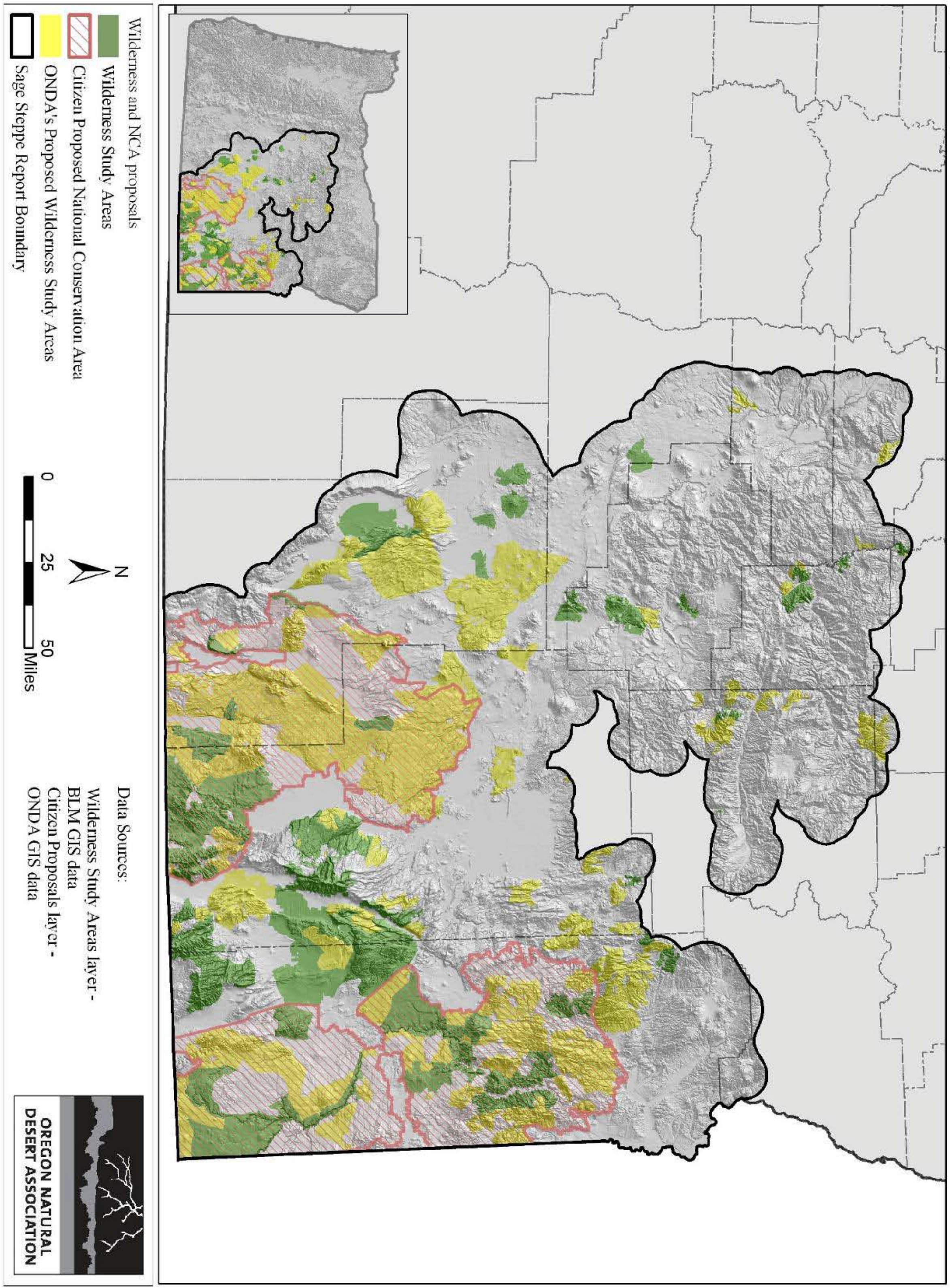
Map 7 Proposed Wilderness and National Conservation Areas
Wilderness and NCA proposals
Wilderness Study Areas
Citizen Proposed National Conservation Area
ONDA's Proposed Wilderness Study Areas
Sage Steppe Report Boundary
N
0 25 50 Miles
Data Sources:
Wilderness Study Areas layer - BLM GIS data
Citizen Proposals layer - ONDA GIS data
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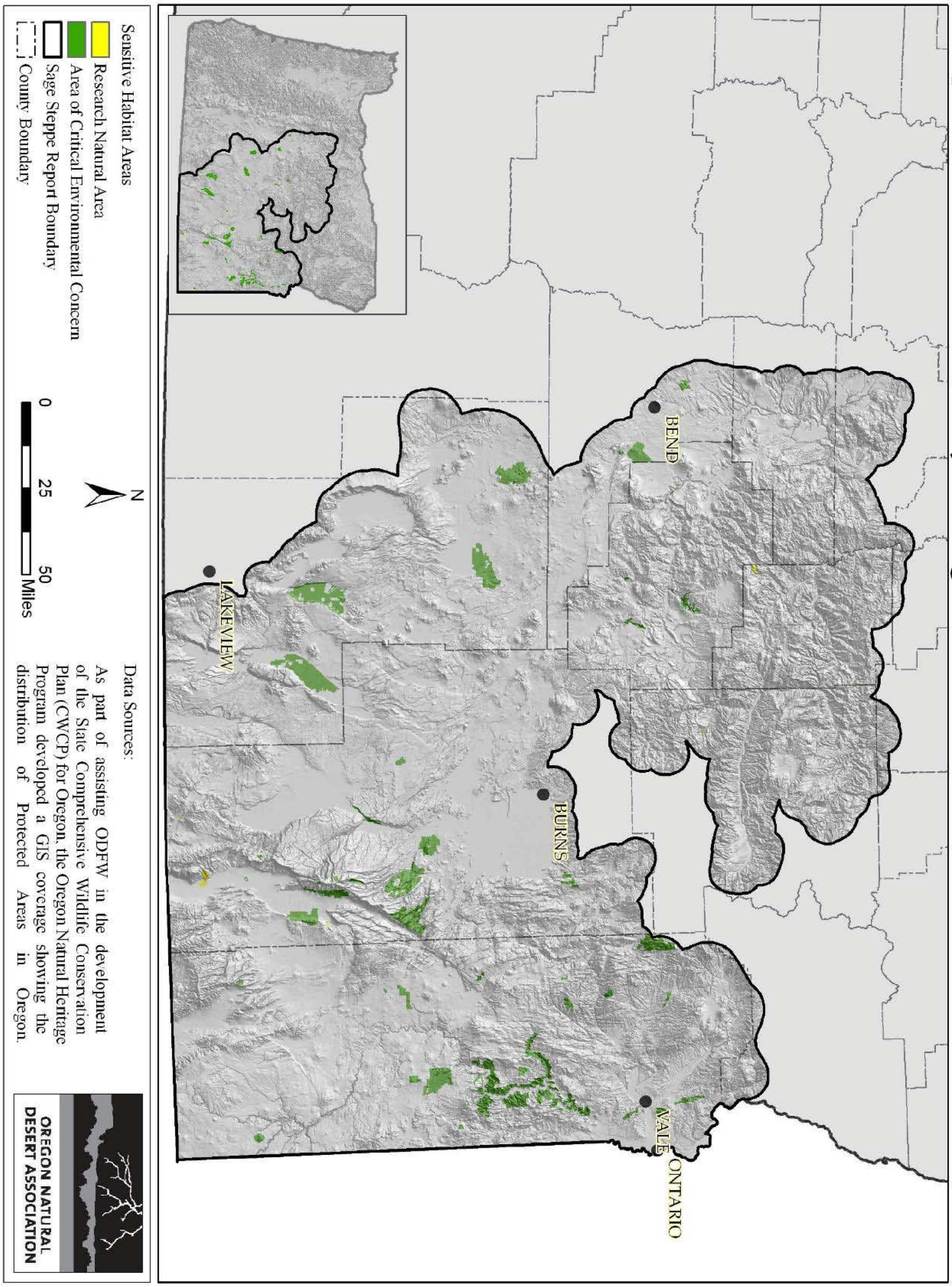
Map 8
Federally Designated Sensitive Habitats
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Sensitive Habitat Areas
Research Natural Area
Area of Critical Environmental Concern
Sage Steppe Report Boundary
County Boundary
N
0 25 50 Miles
Data Sources:
As part of assisting ODFW in the development of the State Comprehensive Wildlife Conservation Plan (CWCP) for Oregon, the Oregon Natural Heritage Program developed a GIS coverage showing the distribution of Protected Areas in Oregon.
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Under the Wilderness Act of 1964 and the Federal Lands Policy Management Act of 1976, developments such as roads and wind turbines are not permitted in WSAs and Wilderness, and thus these areas should not be considered for wind power development regardless of their potential.

Photo 3. The Badlands (Greg Burke)

Citizens' Proposed Wilderness

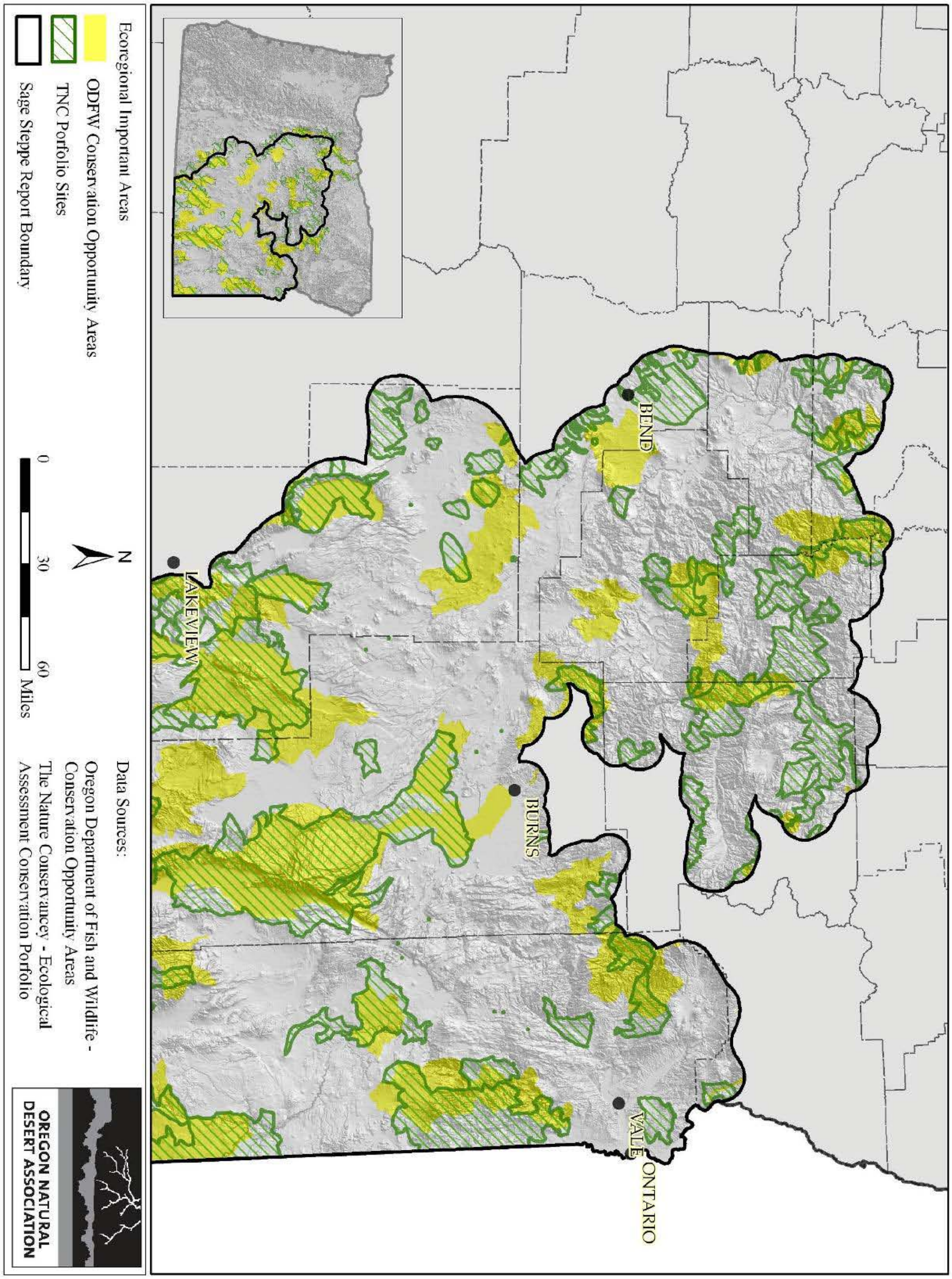
Citizens' proposed wilderness areas in eastern Oregon have been field inventoried and found to possess wilderness characteristics that would make them suitable for formal designation under the Wilderness Act. These areas, typically on BLM lands, may have been excluded from the initial round of Wilderness Study Area designations in the late 1970s due to faulty initial inventories, failures by BLM to examine the areas in question as potential wilderness, or changes in land ownership or physical conditions on the ground which now qualify an area for wilderness consideration. Citizens' proposed wilderness areas represent Oregon's most pristine and outstanding examples of unprotected public lands. There are some of these areas that may be developable after extensive study, mitigation planning, and consultation with conservation organizations and management agencies (Map 7).

Areas of Critical Environmental Concern and Other Special Management Areas

Federal law directs the BLM to establish Areas of Critical Environmental Concern (ACECs) and to protect the sensitive resources for which these lands were designated. Over the years, a number of ACECs have been established under the land use planning process, and others have been proposed in management plans that are currently being revised (Map 8). The designation of ACECs does not confer a uniform set of protection measures; instead each ACEC has its own mandatory set of rules and regulations.

Photo 4. Owyhee Canyonlands (Scott Ericksen)

While most ACECs do not address wind energy development directly, indeed, most were designated before wind power was recognized as a possibility in Oregon, wind energy development in these areas is likely to pose significant challenges and require longer and more expensive permitting processes. Because it will be difficult to show that utility-scale wind power development will be consistent with the protection of resources for which the ACECs were designated (such as Lake Abert and Warner Wetlands which are home to migratory birds), we recommend that ACECs be viewed as avoidance areas by the wind industry.


Map 9
Ecoregional Conservation Plans
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Ecoregional Important Areas
ODFW Conservation Opportunity Areas
TNC Porfolio Sites
Sage Steppe Report Boundary
N
0 30 60 Miles
Data Sources:
Oregon Department of Fish and Wildlife - Conservation Opportunity Areas
The Nature Conservancy - Ecological Assessment Conservation Porfolio
OREGON NATURAL DESERT ASSOCIATION

Best Practices for Special Landscapes

Exclude and buffer these areas from development

Special landscapes in the categories described above should be exempted from consideration for wind power development in order to preserve the attributes for which these lands have received special designations. Viewsheds from these areas should likewise be avoided by siting turbine arrays behind intervening topography or at an adequate distance to avoid visual impacts.

Ecoregional Conservation Plans and Conservation Opportunity Areas

Most conservation plans focus on a single species or a small subset of species, typically those which are unusually charismatic or a species that is the subject of hunting or fishing. The designation of lands in protected areas such as national parks and wilderness also contains biases, over-representing certain habitat types (such as alpine meadows) while other habitat types (like playas and sand dunes) tend to be under-represented (Merrill et al. 1996). However, when considering the conservation of entire ecosystems and the wide array of plants and wildlife they support, it is preferable to take an ecoregional approach because the distribution of plants and wildlife rarely respect arbitrary political designations like state lines and field office boundaries. In Oregon, several ecoregional plans provide a framework for conservation of ecosystems on a large scale, and core habitats and connecting corridors identified in these plans warrant extra caution when planning and siting wind power facilities (Map 9).

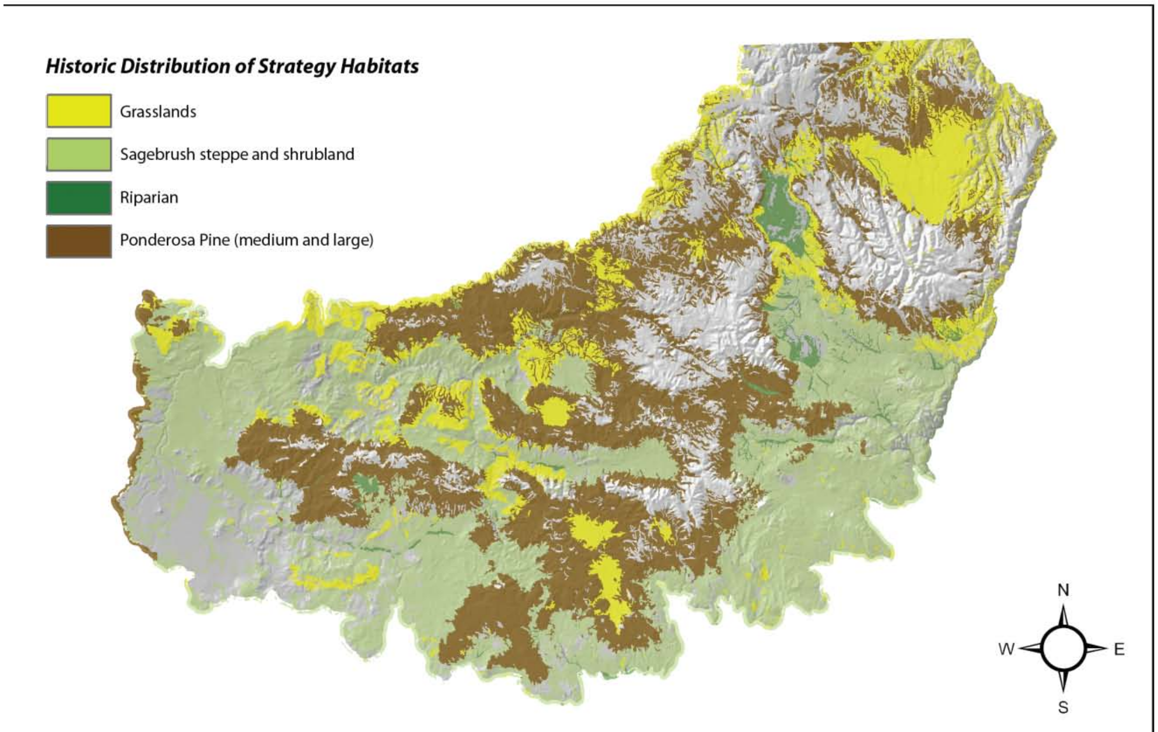
The Oregon Conservation Strategy, the state's wildlife action plan, adopted by the Oregon Fish and Wildlife Commission in 2006, identifies eight ecoregions within Oregon. Two of these ecoregions, North Basin and Range and Blue Mountains, fall within the shrubsteppe extent discussed in this report.

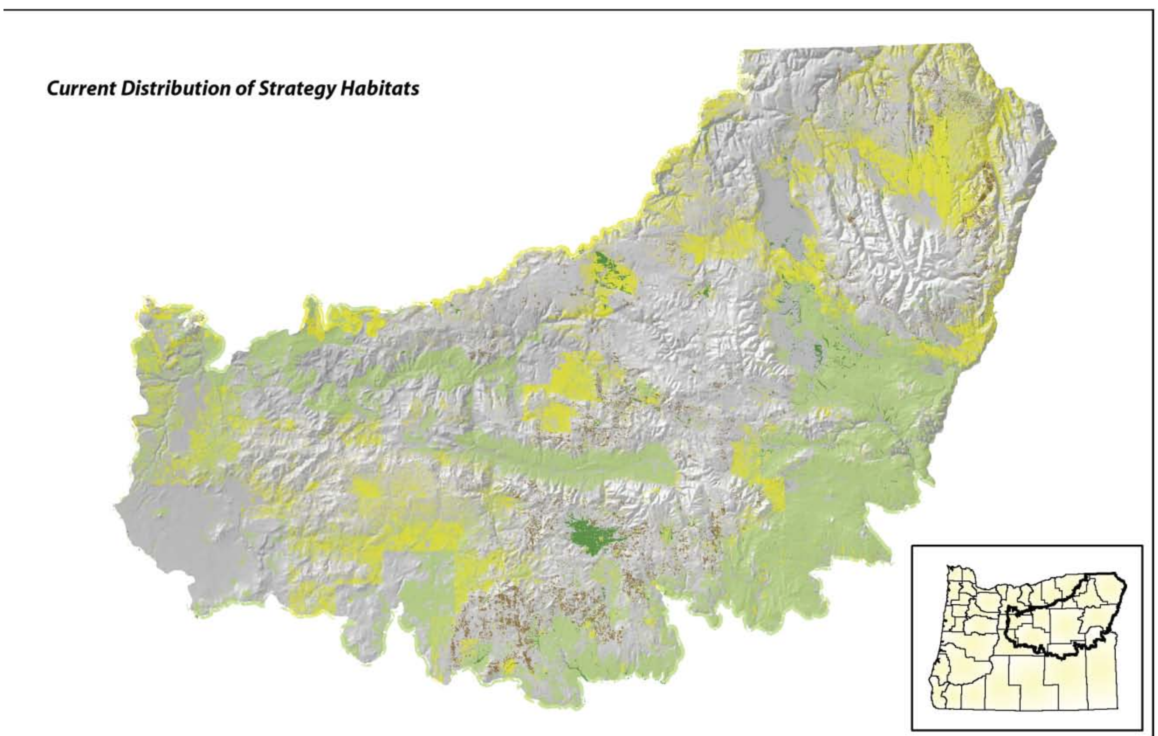
Blue Mountains Ecoregion

The Blue Mountains ecoregion is the largest ecoregion in Oregon and contains a diverse complex of habitat including sagebrush steppe (Map 10). This ecoregion contains some of the largest intact native grasslands in the state although habitats have been impacted by changes in ecological processes due to fire suppression, selective harvest practices, and unsustainable grazing. These changes have exposed areas to increased invasive species and increased vulnerability to wildfire in shrub-steppe habitats (ODFW 2006). The ecoregion encompasses several Conservation Opportunity Areas which provide important habitat for a range of sensitive plant and wildlife species.

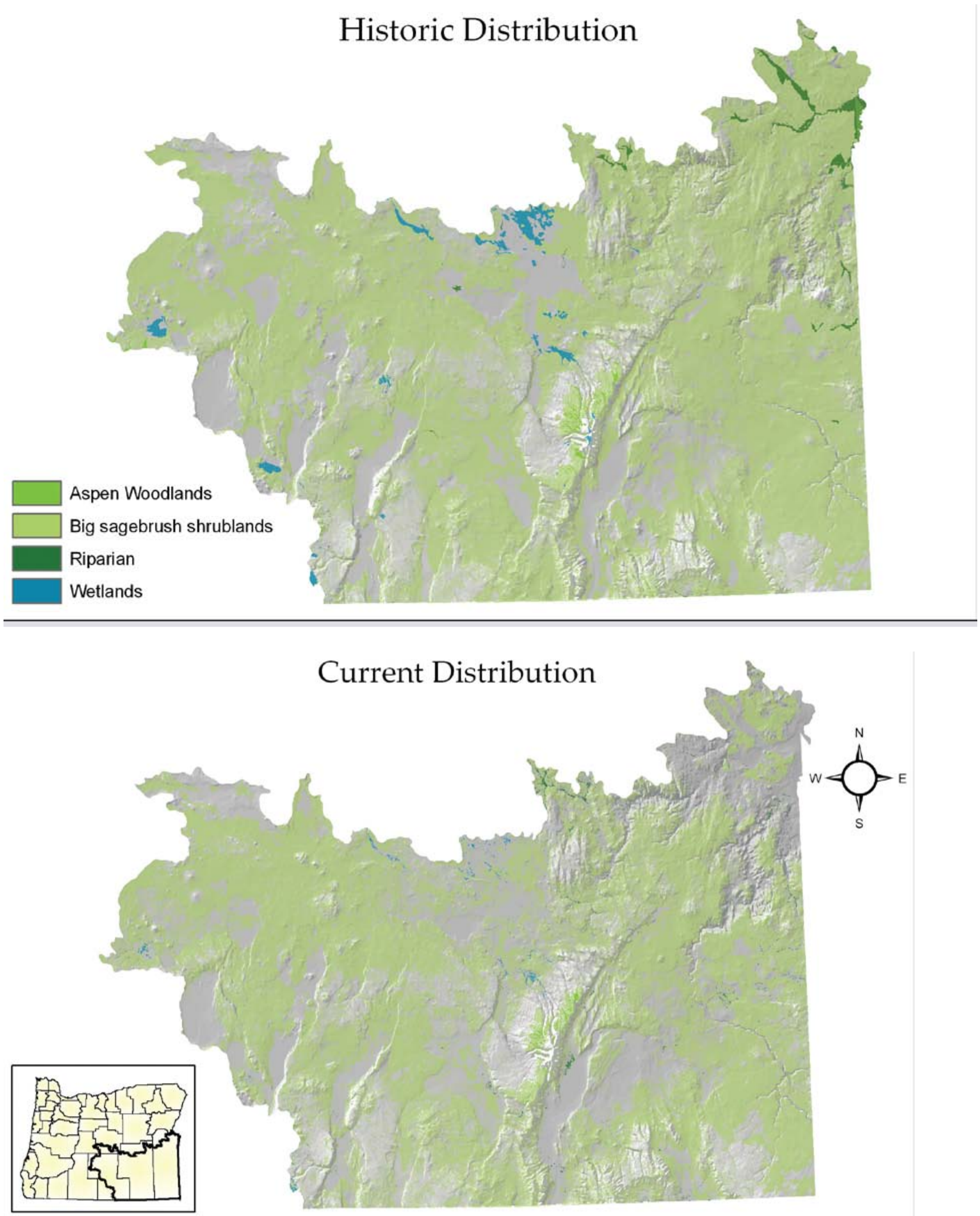
North Basin and Range Ecoregion

The Northern Basin and Range ecoregion covers the southeastern portion of the state, from Burns south to the Nevada border and from Christmas Valley east to Idaho (Map 11). As described by the Oregon Conservation Strategy, the area consists of "numerous flat basins separated by isolated mountain ranges. Several important mountains are fault blocks, with gradual slopes on one side and steep basalt rims and cliffs on the other side. The Owyhee





MAP 10. Historic and current distribution of Blue Mountains Ecoregion habitat types.
(MAP REPRODUCED FROM THE OREGON CONSERVATION STRATEGY. Page 103)
Data Source: Oregon Natural Heritage Information Center, 2004.



MAP 11. Historic and current distribution of Basin and Range Ecoregion habitat types.
(MAP REPRODUCED FROM THE OREGON CONSERVATION STRATEGY; Page 204)
Data Source: Oregon Natural Heritage Information Center, 2004.

Uplands consists of a broad plateau cut by deep river canyons. Elevations range from 2,070 feet near the Snake River to more than 9,700 feet on Steens Mountain." (ODFW 2006).

Best Practices for Ecoregional Conservation Areas and Conservation Opportunity Areas

We recommend that great caution be exercised when siting wind projects in or near ecorregional conservation areas or conservation opportunity areas. These areas provide core habitat and population connectivity for a variety of species. Any proposed development should recognize and not impair the values for which these areas were designated.

Protecting Birds of Prey

Photo 5. Golden Eagle (G. Wuerthner)

Birds of prey have been shown to suffer direct impacts from wind turbines (see page 37 for impacts to sage-grouse and page 48 for impacts to other types of birds). One of the first large-scale wind energy facilities was sited at Altamont Pass in the foothills east of San Francisco Bay. Altamont Pass is a raptor nesting concentration area that also served as a flyway for winter migrations (Thelander and Rugge 2000). Due to the high concentration of birds in this area, the level of fatalities for golden eagles (*Aquila chrysaetos*) and other birds struck by turbine blades rose so high that the facility became famous as "the bird blender". Most of the wind power facilities that followed had much lower rates of bird fatalities, but the reputation of wind turbines as killers of birds has been a difficult one for the industry to escape. The Altamont project highlights the importance of proper siting a facility. The negative public perception created through the siting of this project in an area of high bird concentrations, particularly for golden eagles and other raptors, has made it more difficult for other projects to get started nationwide.

Birds of prey are simultaneously among the most visible and charismatic birds, as well as being more vulnerable to wind turbine fatalities than many other types of birds. At Tehachapi Pass in California, Anderson et al. (2004) found that red-tailed hawks (*Buteo jamaicensis*), American kestrels (*Falco sparverius*), and great horned owls (*Bubo virginianus*) showed the greatest risk of collision of all bird species. At Altamont Pass, Thelander and Rugge (2000) reported that golden eagles, red-tailed hawks, and American kestrels were killed with greatest frequency. In Minnesota, Osborn et al (2008) reported that the American kestrel was at highest risk of wind turbine mortality, spending 31% of flying time at heights within the blade-swept area of wind turbines. Smallwood and Thelander (2005) found that burrowing owls (*Athene cunicularia*) were also highly susceptible to turbine-related mortality, and estimated 181 to 457 burrowing owls were killed per year at the Altamont Pass facility.

Smallwood and Thelander (2005) were able to determine that bird species that spent the most time flying through turbine-swept areas had the highest mortality rates. At the Foote Creek Rim facility, birds that spent the greatest proportion of time flying through rotor-swept heights included raptors and waterfowl (Johnson et al. 2000). These bird groups were found to have the highest risk of turbine collision in California (Osborn et al. 2008).

Wind turbine mortalities can potentially result in population declines in raptor species with the highest turbine strike caused mortality rates. Hunt et al. (1998) found that the golden eagle population was declining and that wind turbine strikes accounted for 38% of mortalities. Even if projects kill primarily non-territorial “floater” birds rather that territorial breeders, population declines can result because stable populations of breeders rely on an abundant supply of floaters to replace birds lost to other sources of mortality (Hunt 1998).

It does not appear that raptors make behavioral adjustments to wind power facilities that reduce fatality rates over time. Indeed, Smallwood and Thelander (2005) found that per-capita risk of raptor fatalities for individual birds actually increased over the 15 years of study, even as raptor densities decreased.

The position of turbines within a tower array does not appear to have a consistent correlation with raptor mortality. For example, Anderson et al. (2004) reported that turbines located at the center of multi-turbine strings experienced higher raptor fatality rates. Meanwhile, the Predatory Bird Research Group (1995) found that end-row turbines produced greater fatality totals at Altamont Pass. Thelander and Rugge (2000) found no relationship between fatality rates and edge or center of array at the same Altamont Pass location.

The type of wind turbine also does not have a clear relationship to rates of raptor mortality. According to the Predatory Bird Research Group (1995), both red-tailed hawks and golden eagles were recorded perching on lattice-type wind generation towers at Altamont Pass. Both species avoided perching on tubular towers but red-tailed hawks were occasionally recorded perching on the catwalks and ladders of such towers in this study. Thelander and Rugge (2000) later found no difference between raptor fatality rates at lattice towers versus tubular towers at Altamont Pass, and Smallwood and Thelander (2005) even found that raptor fatalities at Altamont Pass were greater for tubular towers and larger-rotor turbines. Anderson et al. (2004) found that vertical axis turbines of the FloWind type used at Tehachapi Pass had similar bird fatality rates to horizontal-axis (propeller-style) turbines. Thus, it appears that more modern wind turbines offer no particular advantage in reducing raptor mortality.

It is unclear whether a high density of wind turbines increases or decreases raptor mortalities. Dense clusters of turbines and “wind wall” configurations (parallel rows of wind turbines closely aligned to each other but with alternating tower heights) killed fewer raptors than scattered turbines (Smallwood and Thelander 2005). However, fatality results at Tehachapi Pass suggest that high density sites cause greater fatality rates than low density of turbines (1 turbine per 100 meters), but this difference was not statistically significant (Anderson et al. 2004). More study is needed to determine whether advantages can be gained by altering the density of turbine arrays.

The National Research Council (2007) reported that raptor mortality rates in California per megawatt of installed capacity have been much higher than at other wind facilities across the nation. But Smallwood and Thelander (2005) pointed out that rates of bird fatalities per unit bird/time at Altamont Pass were similar to other turbine facilities, but the much greater bird densities at Altamont Pass drives the high level of fatalities there. According to these researchers:

> “To assert that the APWRA [Altamont Pass Wind Resource Area] is anomalous in its bird mortality may be misleading when comparing it to other wind energy facilities. While a relatively large number of raptors are killed per annum in the APWRA, the ratio of the number killed to the number seen during behavior observations is similar among wind farms where both rates of observation have been reported. It appears, based on the research reports reviewed for this project, that when comparing wind energy facilities birds tend to be killed at rates that are proportional to their relative abundance among wind farms.”

This highlights the critical importance of avoiding raptor concentration areas when siting wind energy facilities. In areas where there are concentrated raptor nest sites, there will be elevated raptor activity as at Altamont Pass, with higher raptor mortality rates. This is of particular concern in cases where raptor nests may be upwind of turbine sites, and strong prevailing wind would have the tendency to carry fledgling raptors with underdeveloped flight skills straight into turbine swept areas.

Raptors can function as keystone species (National Research Council 2007), potentially controlling populations of prey species and inducing trophic cascades. Thus, impacts to these classes of species could result in collateral impacts at the ecosystem level. A certain level of avian mortality is virtually unavoidable with wind power projects, but intelligent siting of turbine arrays should minimize the level of mortality from the project. Such impacts should be minimized by taking the following steps in the siting and operation of wind power facilities.

For the purposes of this report, maps are presented which outline the distribution of raptor species known to be particularly sensitive to wind turbines (e.g. golden eagles and ferruginous hawks (*Buteo regalis*)). It is important to note that detailed data collection has not taken place throughout Oregon’s high desert; that said, certain areas are known to contain high winter concentrations of raptors including the Klamath Basin, Fort Rock Basin extending to Christmas Valley, Silver Lake Basin, Chewaucan Basin (including Summer Lake and Lake Abert), and the Warner Valley (J. Fleischer personal communication). Pre-development monitoring of local raptor populations will be essential to any wind development project.

Best Practices for Birds of Prey

Avoid Siting Turbines Near Raptor Concentration Areas

The Buffalo Ridge wind project in agricultural lands of southwest Minnesota showed low bird mortality rates (0.33 to 0.66 fatalities per turbine per year), likely due to its siting in a lower bird density area (Osborn et al. 2000). These researchers admonished that even a well-sited facility will kill some birds, but siting considerations can be employed to minimize raptor mortalities. At Wyoming's Foote Creek Rim wind facility, only eight percent of bird mortalities between 1998 and 2002 were raptors (Young et al. 2003). This has been attributed to several factors, including low density of raptor nest sites. By avoiding raptor nest concentration areas and migration flyways, raptor fatalities can be minimized.

Avoid Siting Wind Power Facilities in Canyons, Passes, and Other Migration Pathways

Siting turbines in canyons, passes, peninsulas and along ridgelines increases the risk of fatalities for migrating birds. In Montana, Harmata et al. (2000) found that more migrating birds passed over valleys and swales than over high points; while migrating birds tended to avoid passing over high points during headwinds, low passes received greatest use by migrating birds overall. Smallwood and Thelander (2005) found that golden eagles at the Altamont Pass facility were killed disproportionately by turbines sited in canyons. Thayer (2007) recommended, "Don't site wind turbines in canyons" to prevent excessive golden eagle fatalities. We concur with this recommendation, and it should be implemented as a best management practice for wind projects.

Engage in Pre-siting Surveys and Monitoring

Pre-siting surveys of bird habitat use and migration pathways should be undertaken several years prior to the determination of tower locations and arrays. In addition, pre-siting surveys of raptor nesting and winter concentration areas should be undertaken and these areas should be avoided for wind turbine siting. According to Morrisson (2006), "Such pre-siting surveys are needed to appropriately locate wind farms and minimize the impacts to birds." According to Mabee and Cooper (2004), "Seasonal patterns of nocturnal migration are critical to identify when collisions with wind turbines may be most expected." Analysis of bird migration data allowed the company to position its turbines to minimize mortality in the Stateline project of southeastern Washington. Migration patterns should be analyzed prior to the initiation of project construction, and turbines should be sited to avoid them.

Require Setbacks from Windward Rims

At Altamont Pass, Hoover and Morrisson (2005) reported that kiting behavior was most frequently observed on steep windward slopes, and selected for the tallest peaked slopes; slopes where this behavior occurred had a disproportionate amount of red-tailed hawk mortality. In the context of the Foote Creek Rim project, Johnson et al. (2000) also reported higher than expected raptor use of rim edge habitats, and for this project SeaWest implemented a setback of at least 50 meters from the rim for wind turbines to reduce raptor mortality; larger setbacks are likely necessary.

Minimizing Impacts to Bats

Initially, bird mortality was perceived as the most important impact of wind energy projects, but more recently it has come to light that wind turbine facilities can be a major source of bat fatalities as well (Arnett et al. 2008, Kunz et al. 2007b). Bats can function as keystone species (National Research Council 2007), potentially controlling populations of insects and inducing trophic cascades. Thus, projects that cause major impacts to bat populations could also destabilize ecosystem function. Kunz et al. (2007b) reported that bat fatalities at wind power facilities ranged from 0.8 to 53.3 bats per megawatt per year, with the highest mortality rates in forested areas. Taller towers with greater rotor-swept area showed greater bat mortality rates than smaller wind turbines in the same region (Arnett et al. 2008). As the trend within the industry is toward taller wind turbines with larger propellers, it is expected that risk to bats will increase further over time.

Bats may be more vulnerable to mortality at wind power facilities than birds because bats seem to be attracted to operating turbines. Arnett (2005) hypothesized that hoary bats may confuse turbine movements for flying insects and be drawn toward operating turbine blades. Johnson et al. (2004) also hypothesized that turbines attracted foraging bats in the agricultural lands of southwestern Minnesota. The attraction of bats to wind turbines during feeding was validated experimentally by Horn et al. (2008), with foraging bats approaching and pursuing moving turbine blades and then being trapped by their vortices of air. Bats sustain potentially fatal injuries not only from turbine strikes but also from potentially deadly decompression associated with air pressure gradients cased by spinning turbines (Arnett et al. 2008).

Bats are long-lived and have slow reproductive rates and thus are likely to suffer population declines (GAO 2005, National Research Council 2007). According to a resolution from the North American Society for Bat Research (2008), “Because bats have exceptionally low reproductive rates, making them susceptible to population declines and local extinctions, bat fatalities at wind facilities could pose biologically significant cumulative impacts for some species of bats unless solutions are found.” In cases where bat populations are suffering from other population or habitat stressors, wind turbine siting in key bat habitats can contribute cumulative detrimental impacts on the population. This possibility has become much more likely with the rapid spread of the fungal infection known as “white-nose syndrome” in the eastern United States (Veilleux 228). Experts now believe that white-nose syndrome will soon reach western populations as well, and could cause calamitous population declines and even regional extirpations.

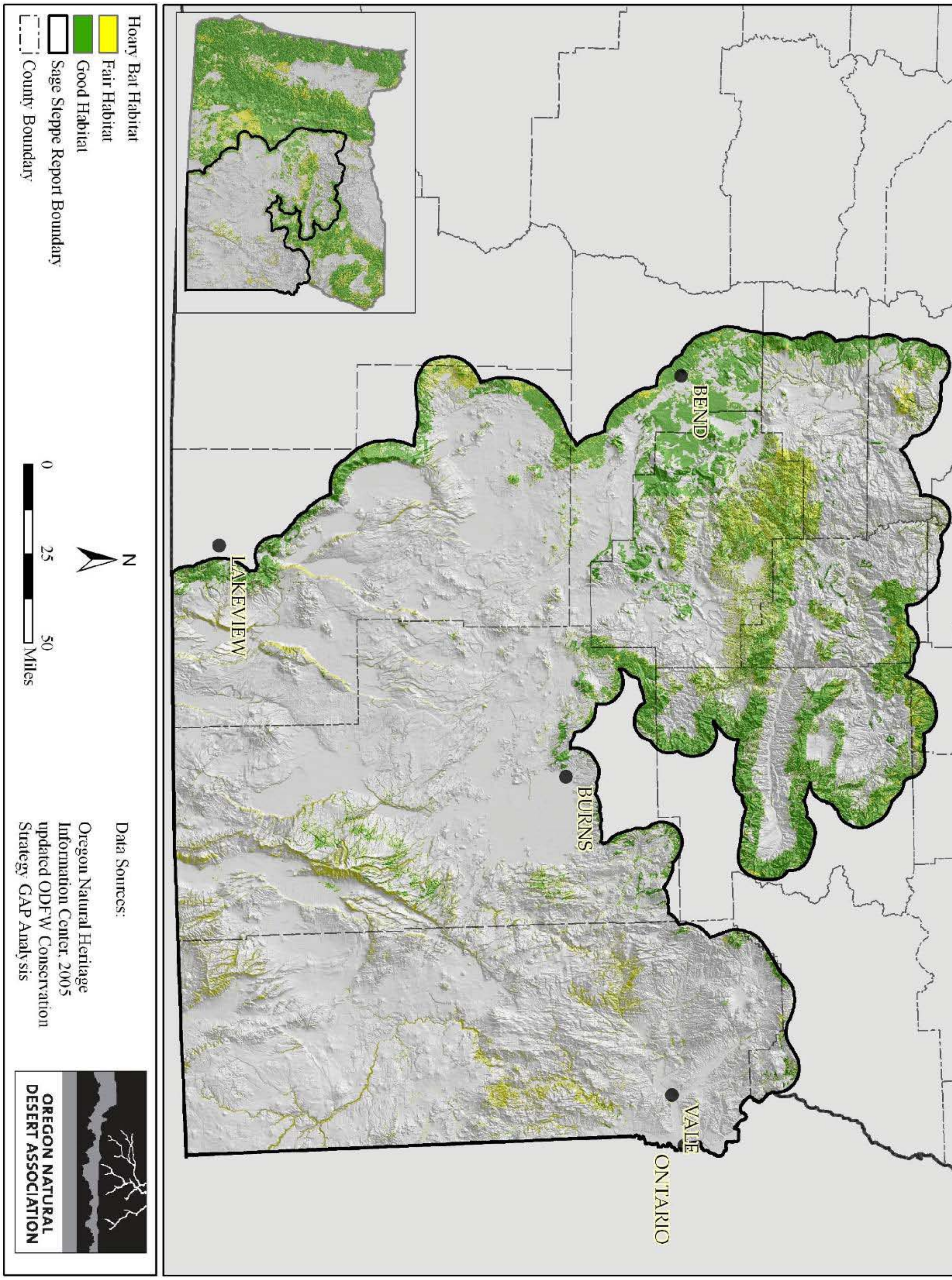
Almost 75 percent of all bats killed by wind turbines nationwide are made up of three species of tree-roosting, migratory bats from the genera *Lasiurius* and *Lasionycteris*: the foliage-roosting eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and tree cavity-dwelling silver-haired bat (*Lasionycteris noctivagans*) (Kunz et al. 2007a, Arnett et al. 2008). Hoary and silver-haired bats dominated bat mortalities at wind facilities sited in open steppe habitats of the interior Columbia Basin (Johnson et al. 2003, Erickson et al. 2003). Johnson et al. (2004) found that hoary bats dominated wind turbine fatalities at the Buffalo Ridge wind facility, even though big brown bats were the most numerous resident population. In the Rocky Mountains, 89 percent of wind turbine bat mortalities are hoary bats (Kunz et al. 2007a). Of the tree-roosting bat species, the hoary bat (Map 12) and silver-haired bat (Map 13) are native to Oregon and are found throughout the state. Both species are considered species of concern by state and federal authorities.

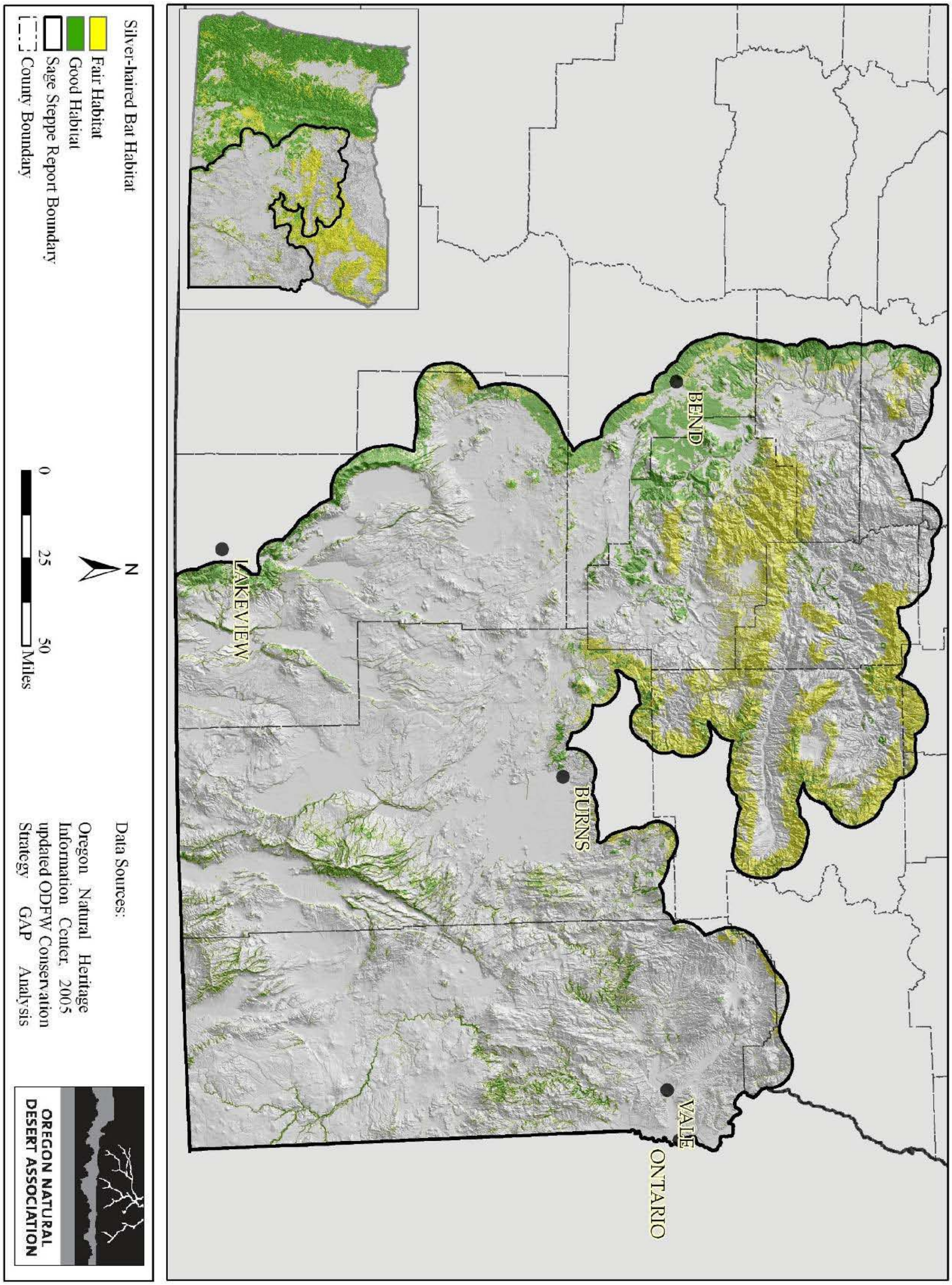
Key habitats for these species are highly variable depending on geographic location. In the western United States, including Oregon, riparian cottonwoods (*Populus spp*) and aspen (*Populus tremuloides*) stands are particularly important for red and hoary bats, whereas large old-growth type conifers are more frequently used by the silver-haired bat (Barclay et al. 1988; Vonhof and Barclay 1996; Betts 1998; Parsons et al. 2003; Kalcounis-Ruppell et al. 2005). Everette et al. (2001) documented hoary bat use of cottonwood groves for roosting on the Rocky Mountain Arsenal near Denver.

In Saskatchewan, Willis and Brigham (2005) found that hoary bats selected as roost trees conifers of similar size to the overall forest canopy that were protected from the wind. Because these species roost in woodlands of all types, bat roosting habitat is indexed by woodland cover types for the purposes of this report.

Wind projects planned in or near woodlands will thus have a greater likelihood of high bat mortality rates. Some of the highest levels of bat mortality were recorded at the Mountaineer wind power facility in the forested mountains of West Virginia, where an estimated 21 bats per night were struck (Horn et al. 2008). Nicholson (2003) reported an estimated 28.5 bats per turbine per year killed at the Buffalo Mountain wind power facility in Tennessee.

Fiedler (2004) reported that bat fatalities in 2004 at a wind power facility in mixed hardwood forest in eastern Tennessee were an order of magnitude greater than at 8 other facilities in the region, and blamed siting on a prominent ridgeline surrounded by forests with rocky outcrops for


Map 12
Hoary Bat Habitat
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Hoary Bat Habitat
Fair Habitat
Good Habitat
Sage Steppe Report Boundary
County Boundary
N
0
25
50
Miles
Data Sources:
Oregon Natural Heritage
Information Center, 2005
updated ODFW Conservation
Strategy GAP Analysis
OREGON NATURAL
DESERT ASSOCIATION


Map 13
Silver-haired Bat Habitat
BEND
BURNS
LAKEVIEW
VALE
ONTARIO
Silver-haired Bat Habitat
Fair Habitat
Good Habitat
Sage Steppe Report Boundary
County Boundary
N
0 25 50 Miles
Data Sources:
Oregon Natural Heritage Information Center, 2005
updated ODFW Conservation Strategy GAP Analysis
OREGON NATURAL DESERT ASSOCIATION

the higher bat mortality at this site and the Mountaineer wind power facility. The National Research Council (2007) found that bat fatalities are higher for eastern sites on forested ridges, although similarly high fatality rates have been shown for croplands in Iowa and southwestern Alberta. Johnson et al. (2004) found that turbines located near woodlands also experienced higher levels of bat activity at the Buffalo Ridge facility in southwestern Minnesota. Arnett (2005) hypothesized that hoary bats may confuse turbine movements for flying insects and be drawn toward operating turbine blades, and that foraging areas such as forests may be particularly problematic in this regard. Arnett (2005) found that bat fatalities were concentrated at both the ends and centers of turbine strings. Numerous studies have found that bat fatalities at turbines lit by red FAA lights and unlit turbines were similar (see, e.g., Johnson et al. 2004, Arnett 2005, Horn et al. 2008).

Best Practices for Bats

Siting Turbines in Open Habitats Rather Than Woodlands

Placement of wind power facilities in woodlands should be undertaken with great caution, and old-growth forests should be avoided entirely. Wind turbines sited at least 1 mile from woodland habitats, whether they be cottonwood, conifer, juniper, or aspen, will have lower probability of high bat mortality rates. Acoustic, radar, and/or thermal imaging surveys for bats should be undertaken to determine population sizes and occupied habitats for hoary and silver-haired bats in and near the project area prior to site selection, and foraging habitats and migration pathways used by these species. Turbine arrays should be designed to avoid identified areas of concentrated bat use.

Bat Mortality Monitoring

Bat mortality monitoring should be a standard protocol for wind turbine operations. Arnett (2005) reported that weekly carcass searches underestimated fatality rates due to high scavenger removal rates, and this researcher recommended carcass searches rotating through a subset of the turbines, so that there are some carcass data coming in each day.

Shutdowns to Avoid Bat Migrations

Johnson et al. (2004) found that bat mortalities are highest in late summer and early fall, coincident with migration periods. If turbines are sited across migration routes or between roosting and feeding areas, then these turbines should have seasonal shutdowns during the migration season(s) or period(s).

Gearing Turbines to Cut In at 6 Meters per Second

In low-wind conditions, bats may not detect turbine blades in time to avoid collisions (Kunz et al. 2007a). Arnett (2005) found that bat fatalities occurred more often on low-wind nights when turbines were still operating, and fatalities increased just before and after the passage of storm fronts. In a later study, Arnett et al. (2008) reported elevated bat mortality from turbine collisions when wind speeds are light (<6 km/hr) and before and after the passage of storm fronts. Cryan (2008) recommended increasing blade 'cut-in' speed to wind velocities greater than 6 meters per second and mandatory shutdown during high risk periods or seasons. Thus, turbines should be set to have a minimum 'cut-in' speed of 6 meters per second to avoid the increased mortality risk to bats at slow turbine speeds.

Conservation of Sage-grouse

Greater sage-grouse (*Centrocercus urophasianus*) were once found in most sagebrush (*Artemisia* spp.) habitats east of the Cascades in Oregon. Populations have fluctuated markedly since the mid-1900s with notable declines in populations from the 1950s to early 1970s. Declines in sage-grouse populations are largely attributed to habitat destruction, degradation and fragmentation (Dobkin 1995). Oregon sage-grouse populations and sagebrush habitats likely comprise nearly 20% of the North American range-wide distribution (Connelly et al. 2004) and therefore the conservation of Oregon sage-grouse populations has national implications for the survival of this sensitive species (Map 14).


Photo 6. Sage-grouse (Cal Elshoff)

The Greater sage-grouse population has declined as much as 45–80 percent over the past 20 years due to habitat destruction, degradation and fragmentation, with the current breeding population estimated at 140,000 individuals, representing only about eight percent of historic numbers (Connelly and Braun 1997). A 2004 survey by state and federal scientists found that sage-grouse are in long-term decline, with the report concluding it was "not optimistic about the future of sage-grouse because of long-term population declines coupled with continued loss and degradation of habitat and other factors." (Connelly et al. 2004). Preserving areas of intact habitat is critical to avoid the loss of this species.

Recognizing that Oregon is an area of critical importance for the species' survival, Oregon's Department of Fish and Wildlife (ODFW) has adopted a conservation strategy for the sage-grouse (Hagen 2005), underscoring that human activities and structures decrease the quality of sage-grouse habitat and can result in habitat loss and direct bird kills. The strategy recommends that land management agencies carefully evaluate actions that could lead to harm to sage-grouse habitats. Specifically, new energy development and associated transmission projects "should avoid surface occupancy within 3.2 km (2 mi) of known/occupied sage-grouse habitat" and follow "existing utility corridors and rights-of-ways to consolidate activities to reduce habitat loss, degradation, and fragmentation by new construction" (Hagen 2005; pp 83-84).

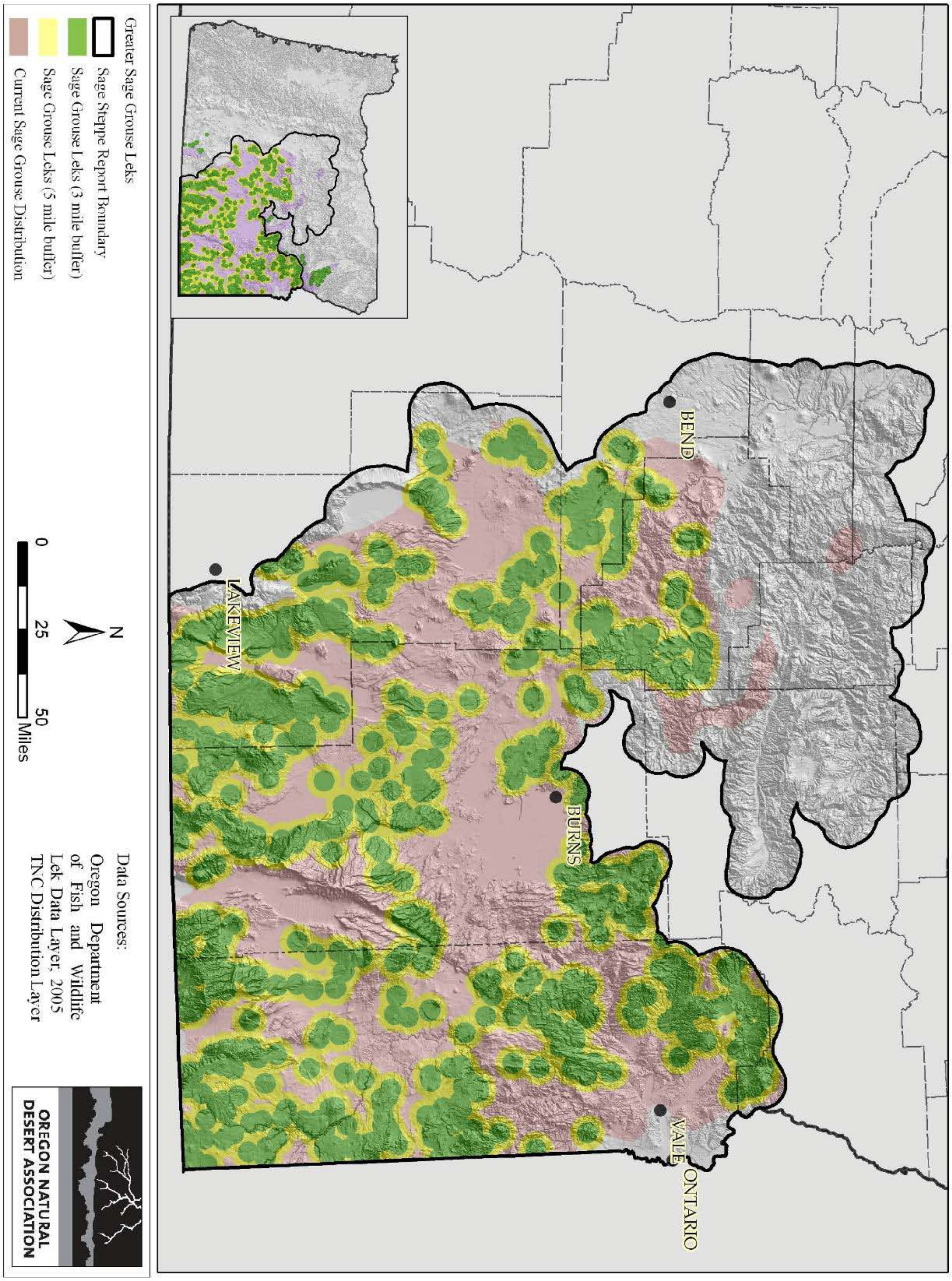
If energy projects and their associated transmission lines cannot be built immediately adjacent to existing transmission lines, ODFW recommends that planners "seek to minimize disturbance to known breeding, nesting, and brood-rearing habitats by placing power line corridors >3.2 km from these areas." ODFW's strategy highlights the importance of preserving habitat integrity and connectivity, noting that,

> "Habitat loss and fragmentation are probably the 2 leading causes for the long-term decline in sage-grouse. Current and future land management will need to examine landscape patterns of sagebrush habitat and seek strategies to ensure that large connected patches of sagebrush are present. The implementation of the connectivity model and habitat monitoring techniques suggested in the Plan will help minimize the impacts of habitat loss and fragmentation" (Hagen 2005: 84).

Similar guidance, stressing the importance of maintaining intact habitat, is found in the BLM's National Sage-grouse Habitat Conservation Strategy and BLM's guidelines regarding Special Status Species such as sage-grouse. In December 2007, the U.S. District Court for the District of Idaho ordered the USFWS to evaluate properly whether the Greater sage-grouse should be listed as threatened or endangered under the Endangered Species Act. The FWS has begun its new review of the sage-grouse's status.

Sage-grouse may be negatively impacted by wind energy development, both from the standpoint of direct mortality from collisions and from displacement from favored habitats due to behavioral avoidance of tall structures and associated development. Much of what is known about the tolerance of sage-grouse to industrial development is derived from studies on oil, gas, and coalbed methane development. Sage-grouse have lost the vast majority of their original population numbers and are sensitive to human disturbance. To the extent that wind power development also involves habitat fragmentation, road construction, and human activity and vehicle traffic associated with maintenance, some of the impacts recorded in the context of oil and gas development likely apply to wind power developments.

The area within 3 miles of a sage-grouse lek is crucial to both the breeding activities and nesting success of local sage-grouse populations. Oregon research shows that most nests occur within 5 miles of a lek while 80% of nests occur within 3 miles of a lek (ODFW Letter to Crook County Planning Commission, 2-23-09). Accordingly, the USFWS recommends a no-development policy within 5 miles of a lek to stem long-term declines in sage-grouse populations (USFWS 2003; Manville 2004). In an effort to preserve 80% of the population, the State of Oregon has established a policy of no development within 3 miles of a lek (Hagen 2005).



Map 14
Greater Sage Grouse Breeding Sites
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Greater Sage Grouse Leks
Sage Steppe Report Boundary
Sage Grouse Leks (3 mile buffer)
Sage Grouse Leks (5 mile buffer)
Current Sage Grouse Distribution
N
0
25
50
Miles
Data Sources:
Oregon Department of Fish and Wildlife
Lek Data Layer, 2005
TNC Distribution Layer
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Autenreith (1985) described the lek site as "the hub from which nesting occurs". Grouse exhibit strong fidelity to individual lek sites from year to year (Dunn and Braun 1986). During the spring period, male habitat use is concentrated within 2 km of lek site (Benson etal. 1991). Other researchers found that 10 of 13 hens nested within 1.9 miles of the lek site during the first year of their southern Idaho study, with an average distance of 1.7 miles from the lek site; 100 percent of hens nested within 2 miles of the lek site during the second year of this study, with an average distance from lek of 0.5 mile (Hulet et al. 1986). In Montana, Wallestad and Pyrah (1974) found that 73 percent of nests were built within 2 miles of the lek, but only one nest occurred within 0.5 mile of the lek site. Holloran (2005) found that 64 percent of sage-grouse nested within 3.1 miles of a lek in western Wyoming while Walker et al. (2007) found that sage-grouse habitat within 4 miles of a lek site was important to the persistence of the lek. Because leks sites are used traditionally year after year and represent selection for optimal breeding and nesting habitat, it is crucially important to protect the area surrounding lek sites from impacts.

Although the impacts of wind energy development on sage-grouse have thus far received little attention, the impacts of development on sage-grouse have been well-studied. Like oil and gas development, wind energy development involves the construction of facilities and road networks, resulting in a level of habitat fragmentation that is similar to full-field oil and gas development. Wind turbines are very tall structures, and are therefore expected to trigger avoidance behaviors in grouse not associated with oil and gas development except during the drilling stage. Transmission towers and overhead transmission lines associated with wind power developments will likely also result in sage-grouse avoidance and provide perches for predators. Unnatural noise from spinning turbines may be equal to or greater than noise associated with oil and gas development, potentially contributing to sage-grouse dispersal away from wind power facilities. On the other hand, vehicle traffic may be less heavy in wind power facilities than in oil and gas fields, and thus the avoidance of wind power facilities due to vehicle traffic may be less than for oil and gas fields. Given the absence of scientific studies of the impacts of wind power facilities on sage-grouse, known impacts of oil and gas development may be instructive.

Lessons to be Learned from Oil and Gas Development

In a study near Pinedale, Wyoming, sage-grouse from disturbed leks where gas development occurred within 3 km of the lek site showed lower nesting rates (and hence lower reproduction), traveled farther to nest, and selected greater shrub cover than grouse from undisturbed leks (Lyon 2000). According to this study, impacts of oil and gas development to sage-grouse include: (1) direct habitat loss from new construction; (2) increased human activity and pumping noise causing displacement; (3) increased legal and illegal harvest; (4) direct mortality associated with reserve pits; and (5) lowered water tables resulting in herbaceous vegetation loss. Pump and compressor noise from oil and gas development may reduce the effective range of grouse vocalizations; low-frequency noise from wind turbines could have a similar effect. A consortium of eminent sage-grouse biologists recommended, "Energy-related facilities should be located

>3.2 km from active leks." And Dr. Clait Braun, an expert on sage-grouse, has recommended even larger buffers of 3 miles from lek sites, based on the uncertainty of protecting sage-grouse nesting habitat with smaller buffers.

Walker et al. (2007) found that coalbed methane development within 2 miles of a sage-grouse lek had negative effects on lek attendance. Holloran (2005) found that active drilling within 3.1 miles of a lek reduced breeding populations, while wells already constructed and drilled within 1.9 miles of the lek reduced breeding populations. Both Holloran (2005) and Walker et al. (2007) documented the extirpation of breeding populations at active leks as a result of oil and gas development in the Upper Green River Valley and Powder River Basin, respectively. Road construction related to energy development is a primary impact on sage-grouse habitat from habitat fragmentation and direct disturbance perspectives. Rowland et al. (2006) modeled sage-grouse distribution, and reached the following conclusions:

> "The secondary road network is a highly significant factor influencing processes in this landscape and is being developed and expanded rapidly across much of the [project area]. Secondary roads are being built as part of the infrastructure to support non-renewable energy extraction. For example, within the Jonah Field in the Upper Green River Valley, >95 percent of the area had road densities >2 mi/mi^2." (Internal citations omitted). [Furthermore,] "The dominant feature affecting output of the sage-grouse disturbance model was secondary roads, which occupy nearly 8 percent of the study area and are presumed to negatively influence an even larger extent."

Holloran (2005) also found significant impacts of road traffic on sage-grouse habitat use in the Pinedale Anticline gas field, concluding that habitat effectiveness declined in areas adjacent to roads with increasing vehicle traffic, documenting the secondary effect referenced by Rowland et al (2006).

Anemometer Towers and Sage-grouse: A Case Study

Even the erection of anemometer towers to test for wind energy potential can cause abandonment of key sage-grouse habitats, as exemplified by the Cotterel Mountain wind project in Idaho. Windland Incorporated was granted rights-of-way by BLM to construct seven meteorological towers, 30 to 150 feet in height and topped with anemometers to measure wind velocity for a commercial wind power feasibility study, along the length of Cotterel Mountain, Idaho in July of 2001 (BLM 2001). Anemometers went into operation the same year (Windland Inc. 2005). In October of 2003, permission to construct an eighth tower was granted (BLM 2003).

As of 2003, there were 9 known sage-grouse leks on Cotterel Mountain, five of which were newly identified that year (Reynolds 2004). On average, 21.5 birds were observed on the leks as a whole, and five leks were used consistently by breeding birds, with a population estimated at less than 50 breeding males. Overall population estimates were 64 to 72 individuals in 2004 and 59 to 66 individuals in 2005 (Reynolds and Hinckley 2005). In spring 2006, the population of sage-grouse on Cotterel Mountain had declined to 16 individuals and seven of nine leks were unoccupied. During this same period, sage-grouse populations elsewhere in the county exhibited steady population trends in 2004 and 2005 and only a very slight dip in 2006 (Collins and Reynolds 2006). It is instructive that the Cotterel Mountain sage-grouse population crashed following installation of anemometer towers across the crest of Cotterel Mountain, while populations elsewhere in Cassia County held relatively steady.

Similarly, subsequent declines in sage-grouse numbers in Oregon at the Sage Hen Hills lek following the construction of a transmission line within 0.5 miles of the lek site raises additional concerns regarding the compatibility of sage-grouse and electrical transmission. The lek had an average of 41 males until 1980. A 500kv powerline was constructed between 1980 and 1982. Since 1981, there has been an average of 5 males per year with no males observed since 2006. This decline occurred during a period of time (1980-1988) when statewide sage-grouse population reached “very high levels” (ODFW, 2008). This displacement from habitat is consistent with the findings in other areas.

Best Practices for Grouse

Avoiding Turbine and Road Construction in Breeding, Nesting, and Winter Habitats

Because wind turbines represent tall structures which sage-grouse are believed to avoid behaviorally, the erection of a wind power facility in, or adjacent to, sage-grouse habitat potentially leads to the abandonment of that habitat by grouse. For this reason, the USFWS (2003, *and see* Manville 2004) recommends siting wind turbine facilities at least 5 miles away from the leks of prairie grouse, which includes the sage-grouse. We support these recommendations and the precautionary approach they adopt in the absence of firm evidence that utility-scale wind power generation is compatible with maintaining sage-grouse habitat function. The same caution should apply to known wintering habitats. Areas within 3 miles of sage-grouse leks are considered as areas with high potential for conflict with areas between 3-5 miles of sage-grouse leks are considered as areas of moderate conflict (Map 14). These recommendations also apply to the placement of anemometer stations.

Burying Powerlines in Grouse Breeding, Nesting, and Winter Habitats

Transmission towers serve as perches for hunting raptors in addition to potentially causing abandonment of sage-grouse habitats through behavioral avoidance. An unpublished study found that sage-grouse habitat use increased with distance (up to 600 meters) from powerlines (Braun, unpublished data, in Strickland 2004). All transmission lines (including high-voltage DC lines) sited within 5 miles of a grouse lek or within ½ mile of winter habitat should be buried. We recommend avoiding active sage-grouse leks by not less than 5 miles unless the turbines would be masked from view of the lek by intervening topography.

Avoiding Impacts to Big Game

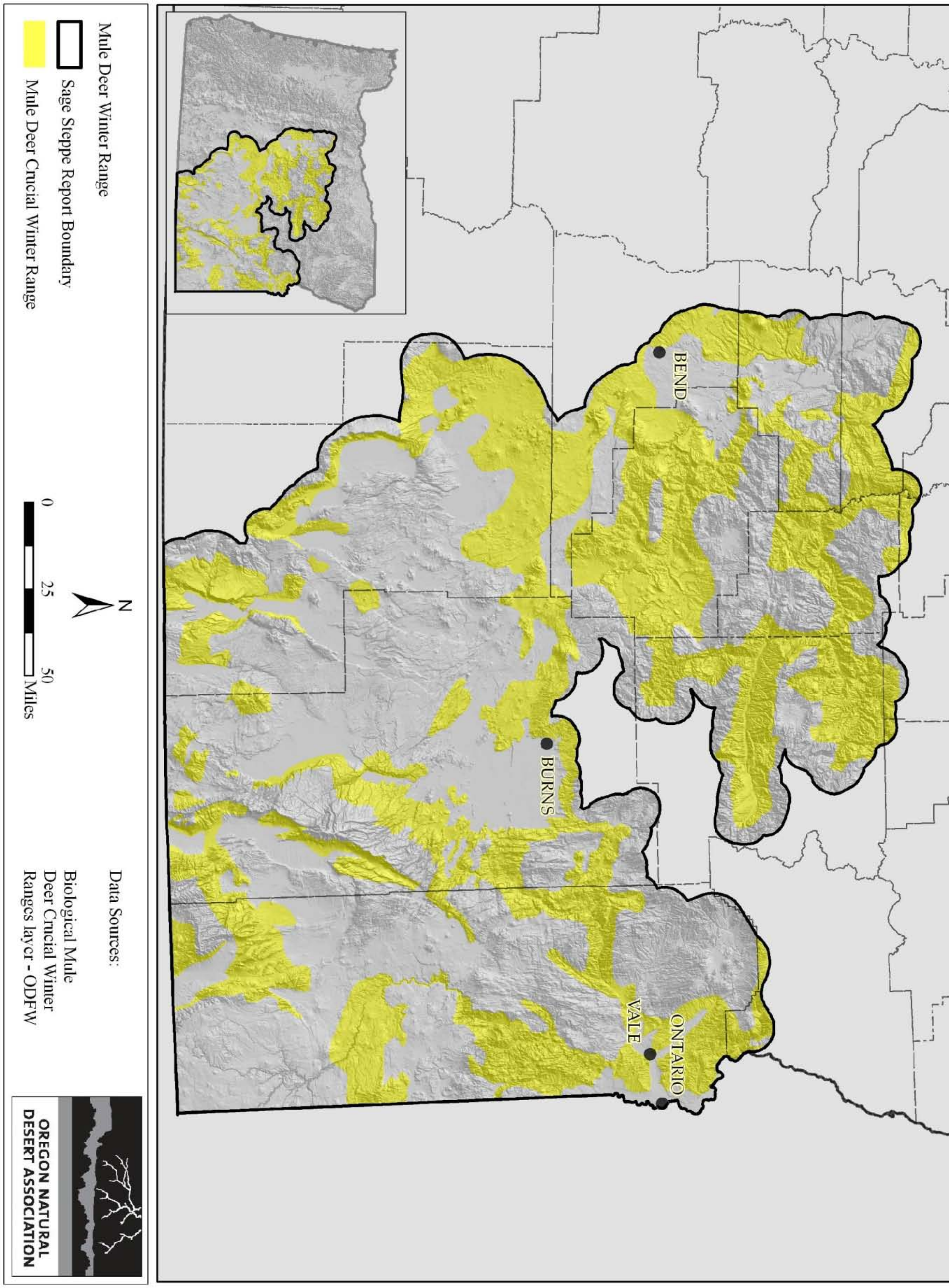
Pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus nelson*) and bighorn sheep (*Ovis Canadensis*) are found throughout Oregon's high desert (Maps 15, 16, and 17). There have been no scientifically rigorous hypothesis tests concerning the impacts unique to wind energy development on big game. According to the National Wind Coordinating Council, "Wind farms also may disrupt wildlife movements, particularly during migrations. For example, herd animals such as elk, deer and pronghorn can be affected if rows of turbines are placed along migration paths between winter and summer ranges or in calving areas" (NWCC 2002).

It is widely agreed that construction-related activities are likely to displace wildlife from their native ranges. It is also important to consider that the impacts of energy development on elk and (to a lesser extent) mule deer have been studied, but for other big game animals, it will be necessary to infer potential impacts using the studied species until more specific scientific research can be conducted. These studies show that big game is negatively impacted by the construction, ongoing disturbance and fragmentation associated with energy development projects.

Photo 7. Rocky Mountain elk(L. Stumpf)

A number of studies have shown that elk avoid open roads (Grover and Thompson 1986, Rowland et al. 2000). Edge and Marcum (1991) found that elk use was reduced within 1.5 km of roads, except where there was topographic cover. Gratson and Whitman (2000) found that hunter success was higher in roadless areas than in heavily roaded areas, and that closing roads increased hunter success rates. On the Black Hills, elk chose their day bedding sites to avoid tertiary roads and even horse trails (Cooper and Millspaugh 1999). Cole et al. (1997) found that reducing open road densities led to smaller elk home ranges, fewer movements, and higher survival rates. Road networks associated with wind development would be expected to displace elk, and thus wind power facilities should avoid the most sensitive habitats and migration corridors.

On winter ranges, elk are highly susceptible to disturbance. They are so sensitive to human disturbance that even cross-country skiers can cause significant stress to wintering animals (Cassirer et al. 1992). Ferguson and Keith (1982) found that while cross-country skiers did not influence overall elk distribution on the landscape, elk avoided heavily-used ski trails. Disturbance during this time of year can be particularly costly, since the metabolic costs of


Map 15
Mule Deer Crucial Winter Ranges
BEND
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ONTARIO
Mule Deer Winter Range
Sage Steppe Report Boundary
Mule Deer Crucial Winter Range
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Data Sources:
Biological Mule Deer Crucial Winter Ranges layer - ODFW
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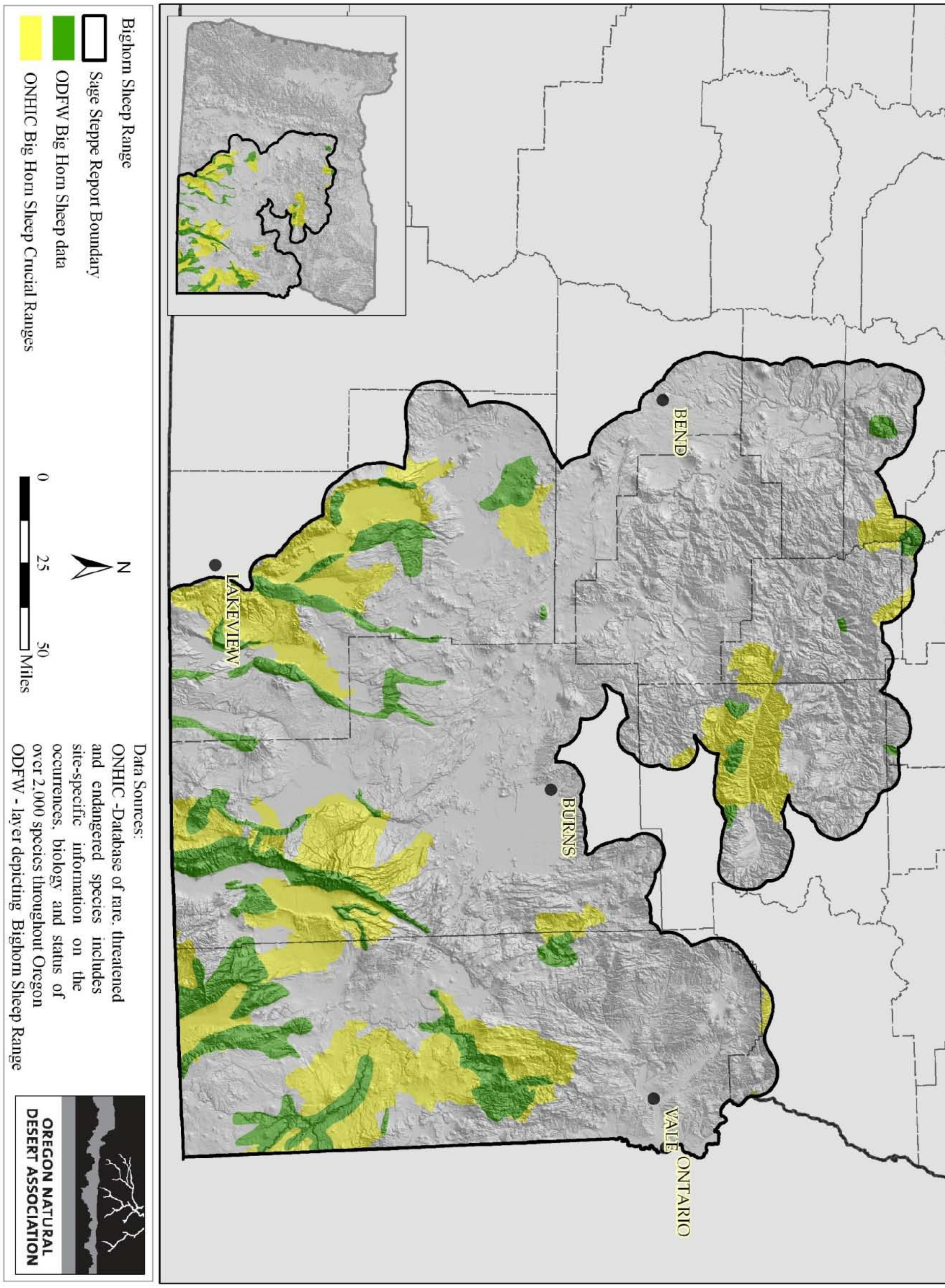
Map 16
Bighorn Sheep Crucial Ranges
BEND
BURNS
LAKEVIEW
VALE
ONTARIO
Bighorn Sheep Range
Sage Steppe Report Boundary
ODFW Big Horn Sheep data
ONHIC Big Horn Sheep Crucial Ranges
N
0 25 50 Miles
Data Sources:
ONHIC -Database of rare, threatened and endangered species includes site-specific information on the occurrences, biology and status of over 2,000 species throughout Oregon
ODFW - layer depicting Bighorn Sheep Range
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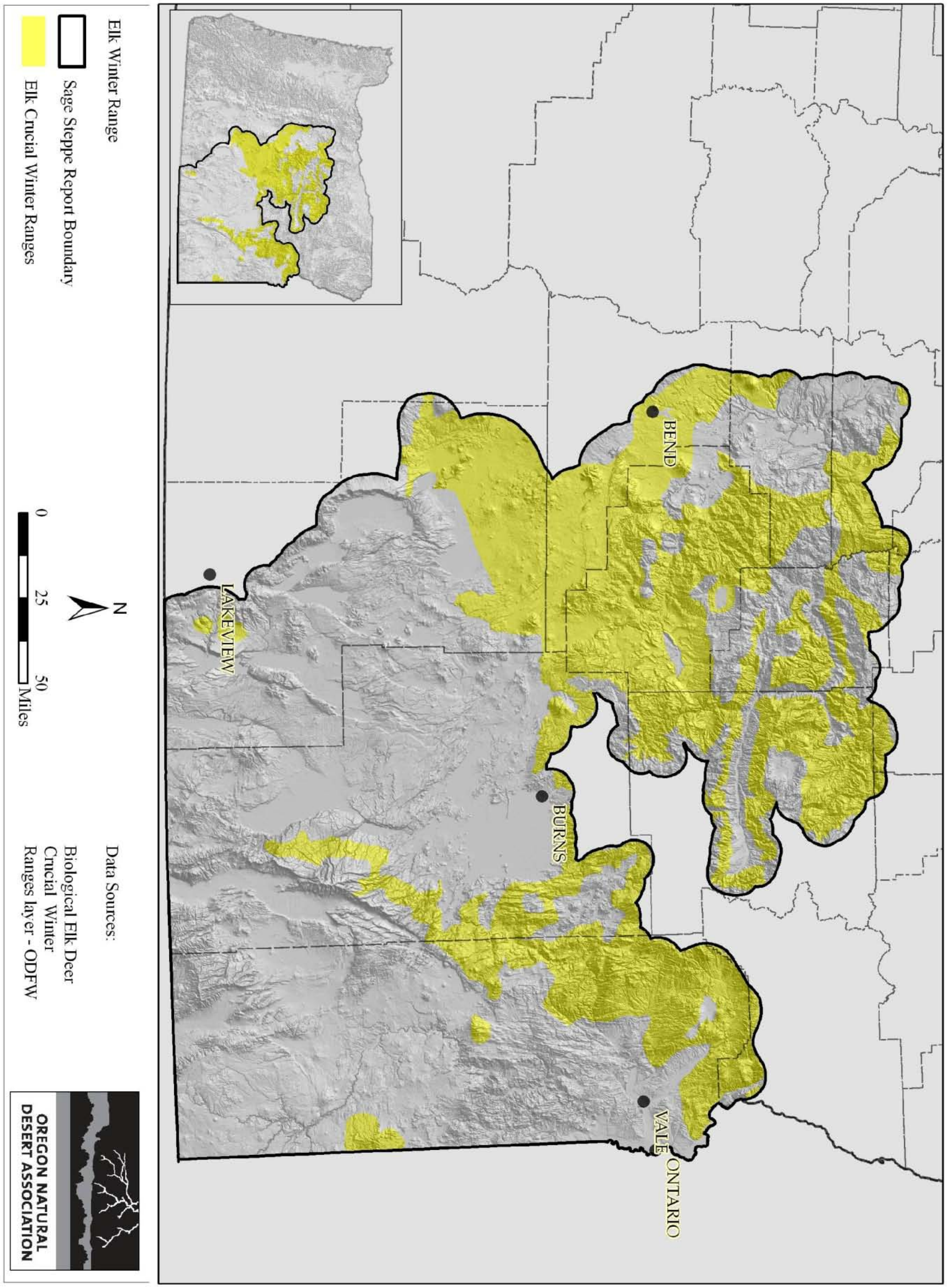
Map 17
Elk Crucial Winter Ranges
BEND
LAKEVIEW
BURNS
VALE
ONTARIO
Elk Winter Range
Sage Steppe Report Boundary
Elk Crucial Winter Ranges
N
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Data Sources:
Biological Elk Deer
Crucial Winter
Ranges layer - ODFW
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locomotion are up to five times as great when snows are deep (Parker et al. 1984). To the degree that wind power facilities involve human presence in crucial ranges during the most sensitive time periods, these developments may tend to displace elk from their preferred habitats into marginal ranges, where habitat conditions may be poor or where they may be forced to compete with resident animals already at or near their carrying capacity.

Several studies have shown that elk abandon calving and winter ranges in response to oilfield development and this has potential implications for utility-scale wind power development. In mountainous habitats, the construction of a small number of oil or gas wells caused displacement of elk from substantial portions of their winter range (Johnson and Wollrab 1987, Van Dyke and Klein 1996) and drilling in the Wyoming Range displaced elk from their traditional calving range (Johnson and Lockman 1979, Johnson and Wollrab 1987). In the sagebrush habitats of the Red Desert, Powell (2003) found that elk avoid lands within 1.5 kilometers of roads and gas well sites during the summer and lands within 0.6 miles during the winter. Sawyer and Neilson (2005) found a similar response to roads during their subsequent investigation in the same area.

For mule deer, Sawyer et al. (2005) found that well field development caused abandonment of mule deer crucial winter ranges for years at a time, and ultimately resulted in a 46 percent decline in mule deer populations. Herds in undeveloped areas showed a much smaller decline over the same period; the affected population has yet to recover to pre-disturbance levels. Migration corridors may in some cases be equally important to large mammals and are potentially susceptible to impacts from wind energy development. With this in mind, big game migration corridors should be accorded similar level of conservation as winter and parturition ranges.

Best Practices for Big Game Crucial Ranges and Migration Corridors

Test Initial Projects before Approving Additional Development in Crucial Habitats

The first projects to be constructed within big game crucial ranges or migration corridors should be accompanied by rigorous scientific studies to determine the level of tolerance of big game for wind power facilities. These studies should: 1) Test the null hypotheses that construction activities have no effect on wildlife habitat selection and describe the area of avoidance if displacement occurs; 2) Test the same hypothesis for operation activities; 3) Determine population level effects, if any; and 4) Determine how long it takes for animals to resume using the wind power facility site. Such studies should use Before-After-Control formats for maximum scientific rigor. If these studies indicate that displacement of big game from a type of sensitive range or migration corridor by wind power development is not significant, then other wind power projects should be free to proceed in that type of range or migration corridor.

Perform Construction Activity Outside the Sensitive Season

Wind power facility construction activities should not occur within 2 miles of crucial ranges or migration corridors during the period of use by wildlife.

Seasonally Restrict Vehicles and Human Presence

Portions of the wind energy facility inside crucial winter ranges or migration corridors should be closed to vehicle use and human presence must be minimized during their period of use by wildlife.

Stewardship for Other Sensitive Wildlife

Wind power projects can affect sensitive wildlife through direct mortality, habitat loss and fragmentation, and displacement of wildlife from preferred habitats due to disturbance. The key to minimizing these impacts is to site wind power facilities in areas of relatively low habitat importance and low likelihood of conflict.

Direct Mortality of Migratory Birds

Wind turbines arrays have the potential to be major sources of migratory bird mortality. Birds have relatively poor hearing, and human ears can detect wind turbines at roughly twice the distance as birds can (Dooling 2002). Mc-Crary et al. (1983, 1984) estimated that 6,800 birds were killed annually at the San Gorgonio wind facility in California. Erickson et al. (2001) reported in a California study that 78 percent of mortalities were songbirds protected by the Migratory Bird Treaty Act, while only 3.3 percent of bird mortalities were unprotected, non-native species such as rock doves (*Columba livia*) or starlings (*Sturnus vulgaris*). At Wyoming's Foote Creek Rim wind facility, 92 percent of bird mortality between 1998 and 2002 was comprised of passerines, or small songbirds (Young et al. 2003).

While it is correct to point out that many other types of human activities have killed substantially more birds than have wind turbines to date, fatalities from turbine collisions are additive to all other stressors of bird populations, which may already be imperiled by other human-caused factors. The 2009 USFWS State of the Birds report found that 25 percent of the species in the United States are experiencing significant declines (including grassland and aridland birds). For these species, it is necessary to consider wind power in the context of cumulative impacts because even low mortality rates attributed to wind power can be significant to a species seeing reductions because of cumulative impacts from multiple sources.

The National Research Council (2007) points out that while turbine fatalities are currently a small portion of human-caused bird mortalities nationwide, locally these mortalities can have important impacts on bird populations. A review of numerous avian and wind studies noted that waterfowl and shorebirds were among those most impacted by wind energy (Stewart et al. 2007).

Woodlands may have greater sensitivity from the perspective of songbird mortality. The National Research Council (2007) found that "Total bird fatalities per turbine and per MW [megawatt] are similar for all regions examined in these studies, although data from the two sites evaluated in the eastern United States suggest that more birds may be killed at wind-energy facilities on forested ridge tops than in other regions." This is not always the case, however: not one dead bird was found by Keppinger (2002) during mortality monitoring at a Vermont turbine facility sited in rolling forested country.

Nocturnal migrations of songbirds should be identified as part of the baseline analysis for wind power projects. Bird migrations often occur at night (Mabee et al. 2006). The highest percentage of fatalities attributable to nocturnal migrants was 48 percent at Wyoming's Foote Creek Rim wind power facility (Erickson et al. 2001). Wind turbines extend into the lowest strata of bird migration with most migrating birds flying at heights above turbine facilities (Kerlinger 2002). Birds may maintain altitude after crossing ridgetops (Mabee et al. 2006), suggesting that wind turbine arrays with the tops of blades positioned lower than nearby ridgetops could result in lower rates of mortality for migratory birds.

Accurate mortality monitoring and before-and-after habitat use studies should be a basic part of all wind facility operations, and have been for many wind power programs to-date. Estimates of bird mortality can be biased by the efficiency of searchers to locate dead birds and by the rates at which scavengers remove the carcasses. Both of these factors vary widely among wind power sites (Morrisson 2002). Searcher efficiency at the Foote Creek Rim was estimated at 90 percent for medium and large birds and 60 percent for small birds based on experimental trials (Young et al. 2003). Arnett (2006) found that trained dogs had a much higher efficiency of finding bird mortalities (71-81 percent) versus human searchers (14-40 percent) in the eastern U.S.

Habitat Impacts for Birds

In addition to sage-grouse, several other species are dependent on sagebrush ecosystems and sensitive to habitat changes. These species include Brewer's sparrow (*Spizella breweri*), Sage sparrow (*Amphispiza belli*), and Sage thrasher (*Oreoscoptes montanus*) (Rotenberry and Knick 1999; Knick and Rotenberry 2000). Dobkins and Sauder (2004) found that numerous shrub-steppe bird species were already at-risk due to existing habitat fragmentation. In this review, southeast Oregon was found to have relatively high species richness for upland birds compared to other shrub-steppe habitats throughout the West (Map 18).

Photo 8. Black-necked stilt ((*Himantopus mexicanus*) (Greg Burke)

Wind turbine arrays are likely to result in further habitat fragmentation and the displacement of sensitive wildlife away from developed areas. Leddy et al. (1999) found that the Buffalo Ridge wind project area had a density of grassland passerines four times lower than surrounding habitats, indicating that songbirds avoid wind turbine arrays in their habitat selection. Fragmentation of shrubsteppe habitats has a particularly strong negative impact on birds. Knick and Rotenberry (1995) found that sage sparrows and sage thrasher populations decreased with decreasing patch size and percent sagebrush cover, and reached the following conclusion:

> "Our results demonstrate that fragmentation of shrubsteppe [habitats] significantly influenced the presence of shrub-obligate species. Because of restoration difficulties, the disturbance of semiarid shrubsteppe may cause irreversible loss of habitat and significant long-term consequences for the conservation of shrub-obligate birds."

Kerley (1994) similarly found that small patches had fewer shrub-nesting species than large patches, and the green-tailed towhee, an interior sagebrush species, was entirely absent from small patches.

Wind turbine facilities can contribute to habitat fragmentation, potentially displacing some species. The Searsburg facility in Vermont showed a decline in interior forest birds and an increase in edge adapted birds such as robins and jays using the area, likely associated with the clearings constructed for turbine towers and roads (Kerlinger 2002).

Morrisson (2006) summed up habitat impacts as follows: "For wind developments, issues of habitat involve (1) outright loss because of development, (2) indirect impacts because of disturbance (i.e., the animal will no longer reside near the development), and (3) disruption in animal passage through or over the development because of the addition of towers and turbines." The American Society of Mammalogists (2008) has recognized that wind power projects lead to habitat fragmentation and wildlife displacement. Many of these impacts are avoidable through proper siting, according to the National Research Council (2007): "To the extent that we understand how, when, and where wind-energy development most adversely affects organisms and their habitat, it will be possible to mitigate future impacts through careful siting decisions." Another important factor is indirect habitat loss as a result of increased human presence, noise, or motion of operating turbines (NWCC 2002).

Small Mammals

A number of small mammals associated with shrub-steppe ecosystems are known to be declining or rare. These include pygmy rabbit (*Brachylagus idahoensis*), Washington ground squirrel (*Spermophilus washingtoni*), and kit fox (*Vulpes macrotis*). Remarkably little is known about the distribution or population status of most small mammal species in shrub-steppe ecosystems. Research suggests that many of these species exist only as small, disconnected populations (Yensen and Sherman 2003) and thus are sensitive to disturbance. A recent review of existing data found that a number of small mammal species associated with shrub-steppe ecosystems are already at-risk due to habitat fragmentation (Dobkins and Sauder 2004). Among these species, southeast Oregon was found to have relatively high diversity of upland and riparian mammals compared to other areas throughout the West (Map 18).

Impacts of wind power projects to burrowing rodents are uncertain. Some studies indicate that wind power development can be compatible with burrowing mammals. At Altamont Pass, some species of burrowing rodents and rabbits clustered around turbine towers, attracting foraging raptors (Smallwood and Thelander 2005). Johnson et al. (2000) found that populations of prairie dogs (*Cynomys*) and ground squirrels showed no apparent decline in response to wind turbine construction and operation at Foote Creek Rim.

Photo 10. Pygmy rabbit (E. Rees)

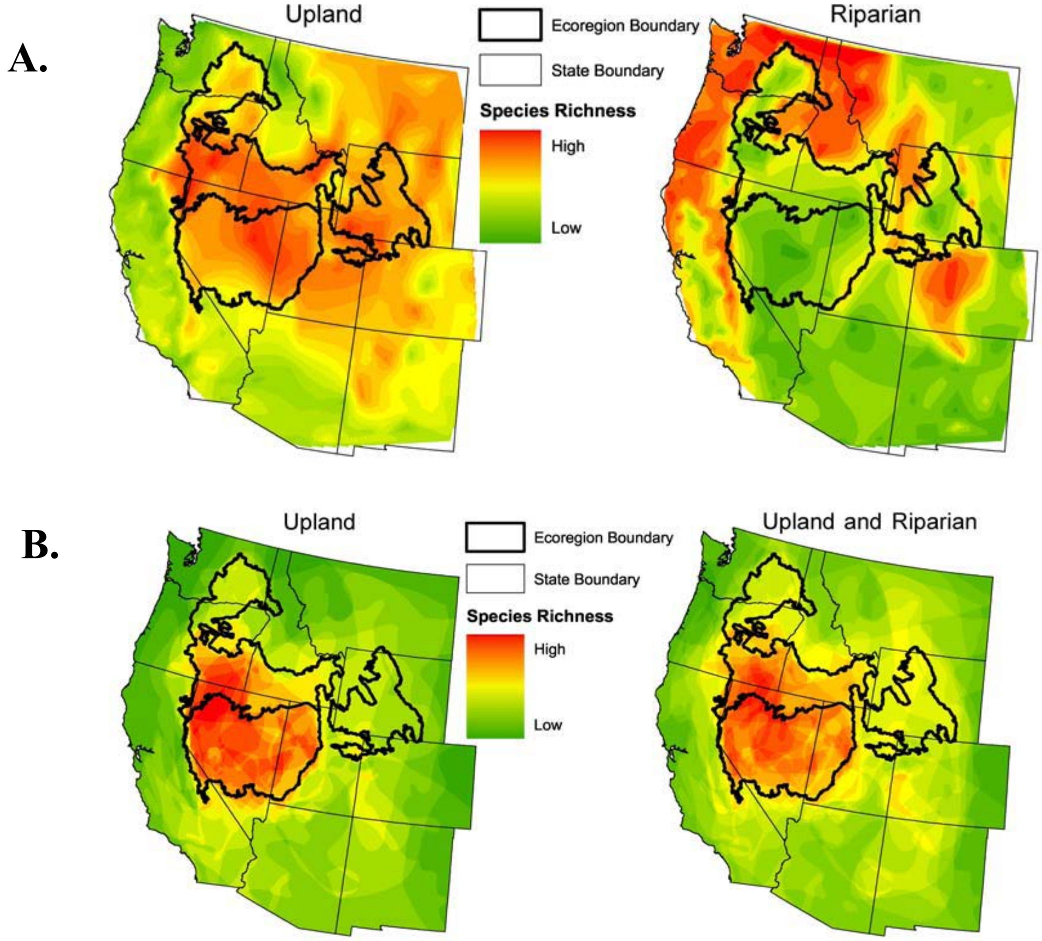
On the other hand, fragmenting small mammal habitat can have negative consequences. Pygmy rabbits have suffered population declines over the past several decades and several groups have petitioned the USFWS to protect this diminutive species under the Endangered Species Act. Purcell (2006) noted that the conversion of big sagebrush communities to energy production sites can creates a concern for pygmy rabbits. Katzner (2004) indicated that habitat fragmentation can reduce the size, stability and success of pygmy rabbit populations because these animals are reluctant to cross open habitats. Roads and wellpads clearly fall into this category.

There have been numerous studies showing that an increase in perches and nesting sites associated with the construction of buildings, transmission poles and other infrastructure leads to increases in raptor and corvid populations. Such inflated populations can result in unnaturally high predation of resident rodents, birds and other prey species.

Best Practices for Other Sensitive Species

Conduct Pre-siting Wildlife Surveys to Determine Optimum Siting

Morrisson (2006) is one of many researchers that have conducted studies of bird habitat utilization and migration patterns in advance of wind energy development. By determining the habitat use on the project scale, turbines can be sited away from high-value bird habitats. This researcher concluded, “Such pre-siting surveys are needed to appropriately locate wind farms and minimize the impacts to birds.” Surveys should be applied generally, and will be particularly important for projects sited in natural habitats.



Map 18. Geographic patterns in bird and small-mammal communities of the western shrubsteppe.**

(*A*) *Species richness for 21 upland and 11 riparian shrubsteppe bird species, based on presence-absence data from the Breeding Bird Survey. Maximum species richness on these maps is 21 species for upland birds and 11 species for riparian birds.*

(*B*) *Species richness for small mammals based on historical range maps for 18 upland species only, and for 24 upland and riparian species combined. Maximum species richness on these maps is 13 species for upland mammals alone, and 18 species for upland and riparian mammals combined. Small sample size prevented meaningful separate analysis of riparian mammals.*

*****REPRODUCED FROM Dobkin and Sauder 2004:21.***

Avoid Rodent Control Programs to Mitigate Raptor Mortalities

Rodent control programs to reduce prey availability have been ineffective in reducing raptor mortality at Altamont Pass (Smallwood and Thelander 2005, GAO 2005). Given the potential sensitivity of the small mammal populations in Oregon's shrub-steppe ecosystems, programs to reduce or eliminate rodent populations to reduce mortality rates of hunting raptors will likely result in a net environmental loss.

Requiring Unguyed Meteorological Towers

Meteorological towers associated with wind power facilities also can be a major source of avian and bat mortality. Guyed meteorological towers show a 3 times higher fatality rate than turbines themselves at Wyoming's Foote Creek Rim facility, with collisions with guy wires primarily responsible for bird deaths (Young et al. 2003). The Nine Canyon wind project in Washington used an unguyed meteorological tower, which resulted in no recorded bird or bat fatalities (Erickson et al. 2003). Meteorological towers should be of the free-standing, unguyed variety to minimize additional avian and bat mortality.

Aesthetic Values and the Human Element

Bisbee (2005) remarked that "Popular visual aesthetic preferences are the primary obstacle to obtaining the emission reductions and other benefits wind power offers." Historically, concerns about visual impacts, particularly in the vicinity of towns, have sparked high levels of concern. According to Gipe (2005),

> "Opinion surveys show that wind has high public support, but a worrisome NIMBY ["Not In My Back Yard"] factor. This support erodes once specific projects are proposed. Because support is fragile and can be squandered by ill-conceived projects, the industry must do everything it can to insure that wind turbines and wind power plants become good neighbors. One means for maximizing acceptance is to incorporate aesthetic guidelines into the design of wind turbines and wind power plants."

According to Cownover (2007), "The size, number, scale, motion and visual prominence of wind turbines makes visual mitigation nearly impossible and communities are faced with challenges in embracing green technology while protecting landscape views they value." In a Riverside County (California) survey regarding the San Gorgonio wind facility, most residents were ambivalent about whether wind energy

Photo 11. Pike Creek Canyon, Steens Mountain (G. Burke)

development was worth the aesthetic cost, while the remainder was evenly split between supporters and opponents of the wind facility (Gipe 2005).

It is critically important for the proponents to implement projects in a way that engenders public support rather than backlash, both to ease acceptance of projects and to ensure that future wind projects do not engender immediate resistance. According to Pasqualetti (2000),

> “If developers are to cultivate the promise of wind power, they should not intrude on favored (or even conspicuous) landscapes, regardless of the technical temptations these spots may offer. Had this been an accepted admonition twenty years ago, the potential of the San Gorgonio Pass might have carried with it the threat of public backlash sufficient to cause more farsighted developers to hesitate. This argues for a more careful melding of land use, scenic values, public opinion, and environmental regulations with the technical considerations of each site.”

Pasqualetti added, “Such spatial realities, even if amplified by only a few vocal objectors, can rob momentum and dull enthusiasm for renewable energy.” In New York State, the Town of Warren (2006) established lands within 5 miles and lands within 8 miles of turbine sighting as the area of visual impact analysis. Sterzinger et al. (2003) also used a 5-mile viewshed radius, while the National Research Council (2007) recommended a 10-mile radius for examining viewshed impacts of wind projects and a 15-mile viewshed analysis for particularly important overlooks.

Sterzinger et al. (2003) determined that while it is commonly assumed that wind power development will lower property values for neighboring residents, the empirical evidence shows no reduction in property values for wind energy zones versus areas unaffected by wind development. Hoen (2006) found no property value impacts of wind energy facility construction at a small town in upstate New York, and argued that property values are an independent index of aesthetic quality.

The scale of the project, particularly if that scale is highly visible, is a critical aesthetic factor. National Research Council (2007) warned, “A project that dominates views throughout a region is more likely to have aesthetic impacts judged unacceptable than one that permits other scenic or natural views to remain unimpaired throughout the region.” The Danish wind power program has gained broad acceptance, in part because it is based on a number of small (1 to 30 turbine) projects. The National Wind Coordinating Council (2002) suggested that, “Fewer and wider-spaced turbines may present a more pleasing appearance than tightly-packed arrays.”

Among the recommendations of Gipe (2005) are maintaining aesthetic uniformity within an array (utilizing the same number of blades, similar turbine shapes), avoiding dense turbine spacing, and using low-contrast paint schemes to make the turbines less obtrusive. According to Pasqualetti (2000), "Open space remains the West's greatest attribute and attraction, the inalienable right of all those with the luck to have been born there or—as some believe—the sense to have moved there." One study showed that visibility of wind turbines increased annoyance levels in survey respondents (van den Berg et al. 2008).

The National Research Council (2007) has outlined a process for evaluating the conditions under which the aesthetic impacts of a proposed wind project might become unacceptable or "undue" in regulatory terms, considering the following factors:

- Has the applicant provided sufficient information with which to make a decision? These would include detailed information about the visibility of the proposed project and simulations (photomontages) from sensitive viewing areas.
- Are scenic resources of local, statewide or national significance located on or near the project site? Is the surrounding landscape unique in any way? What landscape characteristics are important to the experience and visual integrity of these scenic features?
- Would these scenic resources be significantly degraded by the construction of the proposed project?
- Would the scale of the project interfere with the general enjoyment of scenic landscape features throughout the region? Would the project appear as a dominant feature throughout the region or study area?
- Has the applicant employed reasonable mitigation measures in the overall design and layout of the proposed project so that it fits reasonably well into the character of the area?
- Would the project violate a clear, written community standard intended to protect the scenic or natural beauty of the area? Such standards can be developed at the community, county, region, or state level.

Project proponents who can answer these questions to the satisfaction of the public will not only be better able to clear regulatory hurdles but also will be better able to gain local support for wind power projects. In addition, wind energy producers who provide electricity free or at reduced rates to local communities might experience less opposition and controversy surrounding wind projects on locations visible from town.

Historical and Cultural Resources

The National Historic Preservation Act's regulations state that an "adverse effect" to historic properties results from the "[p]hysical destruction of or damage to all or part of the Property," "[a]lteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties [36 CFR part 68] and applicable guidelines" or the "[c]hange of the character of the property's use or of physical features within the property's setting that contribute to its historic significance." [36 C.F.R. § 800.5(a)(2)(i-ii, iv)]. Wind power facilities can cause significant impacts to the settings of historical and cultural sites listed on or eligible for the National Register of Historic Places. Wind facilities are seen by the viewer as symbols of technological development (Gipe 2005) and thus are incompatible with historic settings. It would be very difficult to minimize or mitigate the impacts of a wind power array on the setting of a historic property. The best way to avoid this thorny issue is to site wind facilities in such a way that intervening topography masks them from view from historic trails and sites (Map 19).

Visual Resources Management

In its long-term land-use plans, the BLM typically outlines areas where maintaining visual resources is a management priority. In Oregon, wind power development would be precluded by regulation in BLM Visual Resource Management Class I areas (Map 20) which seeks to "preserve the existing character of the landscape." Many if not all areas in this class are Wilderness Study Areas and thus are already precluded from development. It would also be very difficult for a utility-scale wind project to meet the requirements of Visual Resource Management Class II as well. These requirements state:

> "The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape." (BLM Manual H-8410-1)

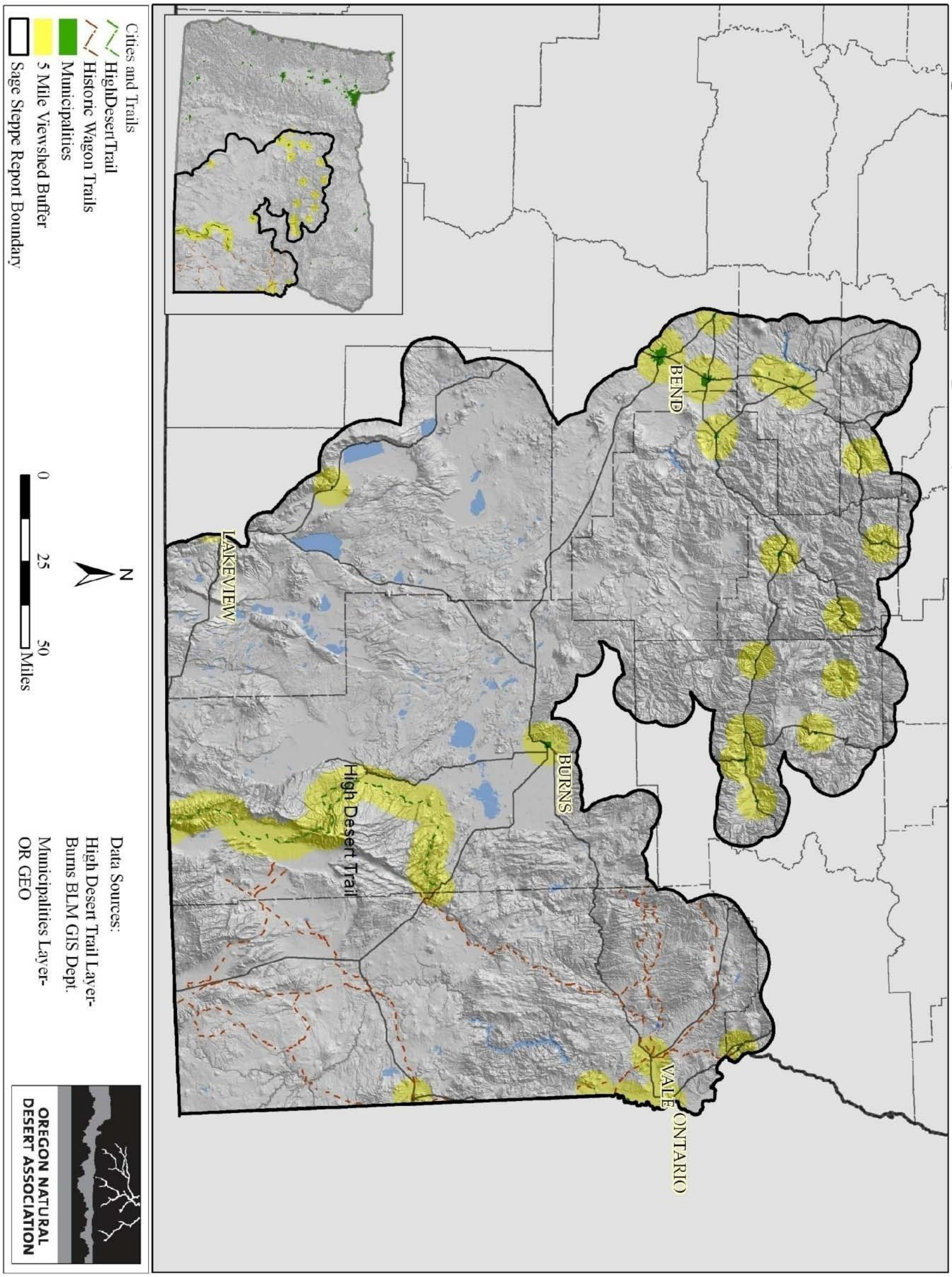
Best Practices for Protecting Aesthetic, Historic Values

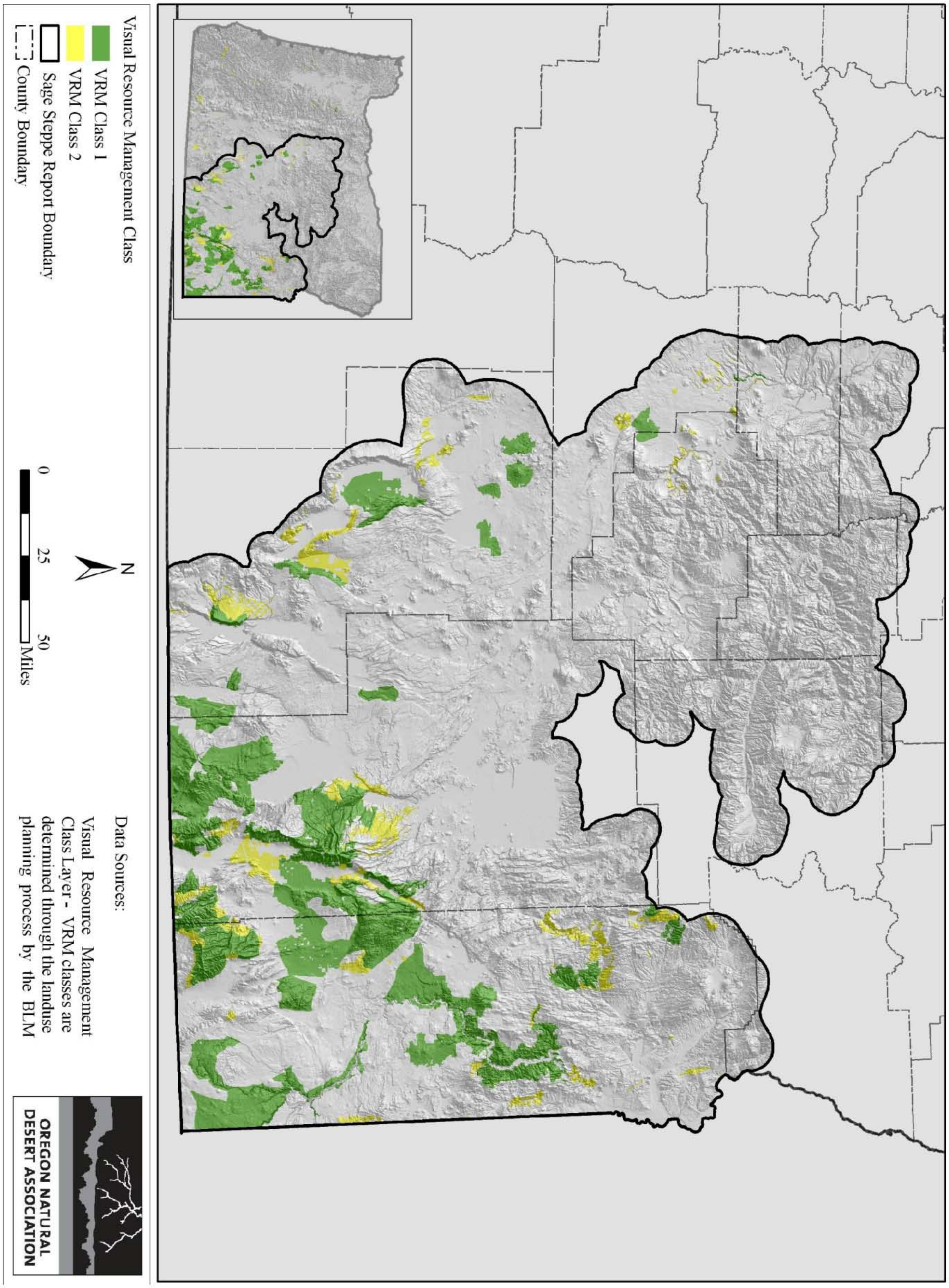
Getting Local Buy-In for Projects within 5 Miles of a Town

An open and inclusive public process benefits wind energy development by allowing public concerns to be addressed and gaining buy-in from neighboring communities. Hasty permitting projects with accelerated timelines result in trouble for wind power projects (NWCC2002). For lands within 5 miles of established towns, we recommend siting wind facilities in areas screened from view by intervening topography, and where this is not possible, getting formal buy-in from the local community via resolutions of approval from elected town bodies.

Minimizing the Impacts of Noise and Shadow Flicker near Dwellings

Impacts of turbine noise and shadow flicker should also be considered, particularly in cases where residents live very close to the proposed turbine array. Turbine noise is generally a factor only within 0.5 mile of the turbine site (National Research Council 2007). In a Netherlands study, van den Berg et al. (2008) found that when noise increased from 30 dBA to 45 dBA, respondents showed increased annoyance. Noise and shadow flicker have been identified as issues in Europe (National Research Council 2007), and shadow flicker has been recognized as a


Map 19 Municipality Viewsheds and Historic Trails
BEND
LAKEVIEW
BURNS
High Desert Trail
VALE
ONTARIO
Cities and Trails
HighDesertTrail
Historic Wagon Trails
Municipalities
5 Mile Viewshed Buffer
Sage Steppe Report Boundary
N
0 25 50
Miles
Data Sources:
High Desert Trail Layer-
Burns BLM GIS Dept.
Municipalities Layer-
OR GEO
OREGON NATURAL
DESERT ASSOCIATION


Map 20 BLM Visual Resource Management Classes
Visual Resource Management Class
VRM Class 1
VRM Class 2
Sage Steppe Report Boundary
County Boundary
N
0 25 50 Miles
Data Sources:
Visual Resource Management Class Layer - VRM classes are determined through the landuse planning process by the BLM
OREGON NATURAL DESERT ASSOCIATION

distraction to drivers and a potential safety hazard in some countries (MSU 2004). For projects sited away from primary access roads and human dwellings, these impacts should be of minor concern.

Shielding the Viewsheds of Historic Properties from Wind Turbines

Within 5 miles of important historic sites and trails, we recommend using great caution by siting wind power facilities only in areas that are visually screened from view from the historic property.

Consulting with Tribes on Traditional Cultural Properties

Wind energy companies should undertake formal consultation with Native American tribes to identify Traditional Cultural Properties, and these should be accorded a similar level of respect and protection as historic trails and sites.

Wind Power Potential and Siting Considerations

To-date, the wind power potential of a site has been the principle (and often the only) consideration driving the siting of wind turbine arrays in Oregon. Map 5 displays the wind power potential of Oregon on a coarse scale. The higher the numerical rating, the stronger the potential is estimated to be for wind energy generation. Areas with a rating of Class 4 or higher are typically viewed as commercially viable however areas rated at Class 3 are now also viable due to improvements in wind turbine efficiency.

The Value of Siting Wind Power in Areas of Few Environmental Conflicts

When all of the sensitive wildlife habitats and high-value landscapes are factored in, Oregon offers a great deal of wind power potential without building turbines in areas that entail heavy impacts or social conflicts. Map 1 shows areas with low to moderate resource concerns and commercial wind power potential. We recommend prioritizing utility-scale wind power in these areas. In addition, these areas are the best candidates for additional electrical transmission capacity to support the growth of the renewable energy industry.

Based on our recommendations, nearly a half-million acres of Oregon's high desert would be suitable for wind power development and have low to moderate potential for environmental or social conflict. Sage-grouse habitats coupled with existing protections for federally-designated conservation areas including Wilderness and Wilderness Study Areas are the primary driver of recommended exclusions.

Adding Value by Siting Wind Energy in Impacted Areas

The first screens in determining where wind energy should be sited should be wind energy potential and avoidance of sensitive habitats and landscapes. Once this first screen has been analyzed, the impacts of wind energy development can be further reduced by siting turbine arrays on lands that have already been heavily impacted by another form of industrial use. Thus, if wind energy must be sited in an area where cautions are indicated, siting facilities in industrialized areas will reduce the chances of resource conflicts. Siting wind towers in areas that are already impacted helps to protect open space, which is a legitimate value even in areas where habitat values are low and aesthetic concerns are not preeminent.

Agricultural Lands

Wind energy is compatible with farming and livestock grazing (Elliott and Schwartz 1993), and the National Wind Coordinating Council (2002) considers agriculture as "a wind-compatible resource." Because wind developments typically take less that 2 percent of the land out of agricultural production and yield additional sources of revenue, they may be especially attractive to private agricultural landowners (Gordon 2004). In a Netherlands study, van den Berg (2008) found that respondents with direct economic benefits were more accepting of wind turbines from visual and noise perspectives. This suggests that siting turbines on private lands may entail greater acceptance as landowners realize direct benefits while the public does not perceive direct compensation for the development of utility-scale wind projects on public lands. Thayer (2007) asserted, "Wind energy development on scenic public lands is less appropriate than wind farming on private rangeland because wind power provides more of a boost for productive farm/ranch management with less controversy over resource/aesthetic controls."

In particular, crop fields that support a monoculture of non-native vegetation tend to provide ecologically impoverished fauna and low biodiversity. Leddy et al. (1999) recommended siting wind turbines in crop fields, which already have reduced densities of grassland birds. In general, bird fatalities at sites located in agricultural croplands have been at the lower end of the spectrum. At the Nine Canyon site, built in wheat fields and grazing lands of central Washington, Erickson et al. (2003) estimated 3.59 bird fatalities per turbine per year and 3.21 bat fatalities per turbine per year, for a total of 133 birds and 119 bats per year for the entire facility. We recommend crop fields as priority areas for wind turbine siting while private grazing lands typically retain a much greater native habitat value and should not be considered sacrifice zones for the purposes of priority wind power facility siting. Leddy et al. (1999) observed that the siting of wind turbines on Conservation Reserve Program lands may cancel out the habitat value of these lands for songbirds. However, feed lots would definitely qualify as areas where wind turbine siting would add minimal additional impact and could be priority sites for wind development.

General Best Management Practices

Transmission Lines

Wind power development is also more economical when sited close to existing transmission lines, particularly for smaller projects. Larger wind projects may generate sufficient electricity to require (and justify) long spur lines of their own. In Oregon, most long-distance transmission lines are already heavily committed, leaving little capacity to carry wind power to distant markets. Thus, the construction of major new electrical transmission lines will be necessary to accommodate any major increase in wind power development. Major new transmission projects sited in areas of high wind power potential are likely to stimulate the construction of new wind power projects nearby. With this in mind, we encourage the construction of major new lines dedicated to wind power transmission into areas of low wildlife and cultural sensitivity, and avoiding the siting of major new lines through zones where wind power development would cause major resource conflicts.

Powerline towers are likely to concentrate raptor nesting and perching activities, to the potential detriment of prey species. Transmission towers may be particularly attractive as nest sites for ravens. Steenhof et al. (1993) reported that 133 pairs of ravens had colonized transmission towers on a single stretch of powerline in Idaho during its first 10 years of existence. Gilmer and Wiehe (1977) found that nest success for ferruginous hawks was slightly lower for transmission towers than other nest sites, and noted that high winds sometimes blew tower nests away. Steenhof et al. (1993) also found that transmission tower nests tended to be blown down, but found that nest success was not lower on towers for ferruginous hawks and was significantly higher on towers for golden eagles. In North Dakota, Gilmer and Stewart (1983) found that ferruginous hawk nest success was highest for powerline towers and lowest for nests in hardwood trees. Thus, although powerlines can be designed to minimize impacts to raptors, these corridors should be sited more than 2 miles away from pygmy rabbit colonies and sage-grouse leks to prevent major impacts to these sensitive prey species. When avoidance is not feasible, burial of the powerlines provides an option that avoids most of the impacts inherent to overhead power lines.

Avoiding Impacts to Sensitive Soils

Depending upon siting, soil erosion may be a concern. According to the National Research Council (2007), "The construction and maintenance of wind-energy facilities alter ecosystem structure, through vegetation clearing, soil disruption and potential for erosion, and this is particularly problematic in areas that are difficult to reclaim, such as desert, shrubsteppe, and forested areas." We recommend siting wind turbine facilities and access routes away from steep (greater than 25 degrees) or unstable slopes or areas with high erosion potential.

Lower-Impact Access Routes

Improved gravel roads have been used in some cases for access to wind turbines in wind power facility settings, while in other cases (particularly in croplands) jeep trails, or no access route at all, are the rule. In most cases, gravel access roads will not only be unnecessary but will also increase the level of project impacts (from dust pollution to wildlife disturbance). We recommend the use jeep trails or no access routes at all to individual turbine towers within a facility development. Vehicle traffic within the turbine array can be further minimized by siting control stations and other related facilities at the near edge of the development to minimize unnecessary vehicle traffic through the turbine arrays.

Appropriate Permitting and Pre-Application Site Evaluation

Wind energy development has the potential to adversely affect important resources that make eastern Oregon's desert unique. Responsible siting of wind power facilities will avoid harm to wildlife, scenic and other resources. This requires robust pre-application site evaluation and an adequate permitting process. Some mitigation of impacts may be possible by applying best practices in designing and operating wind power facilities. Ensuring that site evaluation and mitigation are adequate falls on the shoulders of government agencies that issue permits to develop wind power sites. In Oregon, the responsibility for issuing permits for wind power facilities is split among several jurisdictions. BLM or the Forest Service must approve facilities located on federal lands. On private lands, facilities with an average generating capacity of 105 MW or larger must obtain a site certificate from the Oregon Energy Facility Siting Council (EFSC), while smaller facilities are usually permitted through a county land use process. Smaller facilities that, cumulatively, cause effects that are similar to a single larger facility require an EFSC site certificate.

The divided responsibility for approving wind power projects has resulted in non-uniform standards for evaluating impacts on species, their habitats, and other resources in Oregon. These inconsistencies led to the development of the Oregon Columbia Plateau Ecoregion Wind Energy Siting and Permitting Guidelines (Guidelines), a set of voluntary siting and permitting guidelines designed to avoid or minimize impacts of wind energy facilities on wildlife resources (http://www.rnp.org/resources/OR%20wind%20siting%20guidelines%2008Sept29.pdf).

The Guidelines apply in the northern part of Oregon. Similar guidance should be developed for other parts of the state where wind energy development is in its early stages, including Oregon's high desert. The Guidelines contain a number of specific recommendations for thoughtful and deliberate evaluation of potential wind power facilities. These include:

- Conducting pre-application biological surveys to identify the species (plants and animal) and habitats within the project boundary, after input and consultation with resource agencies.
- Obtaining two (or more years) of seasonal data on wildlife impacts before deciding whether to submit a permit application where (1) use of the project site by the avian groups of concern is estimated to be high, (2) there is little existing relevant data regarding seasonal use of the wind project site or on nearby areas of similar habitat type, and/or (3) the wind project is especially large and/or complex. Many of eastern Oregon's potential wind power sites fall into one of these three categories.
- Conducting pre-project assessment (while preparing the permit application) of potential bird and bat mortality and potential wildlife displacement.

- Using the Oregon Department of Fish & Wildlife's Habitat Mitigation Policy to characterize habitats into habitat categories and to avoid or mitigate impacts consistent with the Policy's mitigation goals for each habitat category.
- Conducting post-construction monitoring to determine wildlife mortality and wildlife displacement, and use such monitoring to determine potential additional mitigation and operational changes in consultation with resource agencies and permitting authorities.

Because the Guidelines provide clear pre-application and pre-construction steps to inventory and help avoid harmful effects to wildlife, we recommend that developers of wind power projects in eastern Oregon follow the principles outlined in the Guidelines until such time as other regionally-specific guidance is available. Permitting authorities should also consider requiring developers to comply with the Guidelines as the current consensus on "best practices" for wind power development in Oregon.

The state EFSC siting process also includes significant requirements for pre-application notice and comprehensive evaluation of the impacts and viability of a proposed wind power development. Notably, EFSC's regulations include mandatory requirements that a developer conduct studies and consult with the ODFW regarding potential impacts to wildlife and propose measures to avoid, reduce or mitigate adverse impacts in accordance with ODFW's mitigation goals. Evaluation of impacts and of potential mitigation that comply with ODFW's standards is a pre-application condition, ensuring that information is available to the permitting agency and the public at the earliest possible stage in the permitting process.

Oregon's counties do not have a uniform process for reviewing land use permit applications for smaller projects, and, in some cases, do not have any standards against which to measure whether an impact to wildlife or other resources is acceptable or unacceptable. We recommend that the counties consider adopting the ODFW mitigation goals as wildlife protection standards in their land use ordinances for power project developments.

For projects where it can be determined early that there may be significant resource conflicts, we recommend that counties require the developer to obtain a site certificate from EFSC, even if the project will have a generating capacity below 105 MW. This will allow the counties and the state to most efficiently apply scarce resources and ensure that uniform, state-wide standards are being used for all projects with significant resource impacts. Also, because of the importance of ensuring against adverse impacts in the design, construction and operation of wind energy facilities, projects permitted at the county level should be required to submit applications that cover all of the topics outlined in the EFSC regulations, to ensure a level playing field for all developers and adequate, pre-application study of potential impacts. Lastly, we recommend that the Counties and the Oregon Legislature consider amending the land use planning statutes to allow an exception to the 150-day statutory deadline for evaluating land use applications for energy facility siting to ensure that there is sufficient time for reviewing often-complex project applications.

Conclusion

By following the recommendations in this report, decision makers and the wind industry can minimize conflicts with sensitive resources and minimize the potential for controversy. In this way, Oregon wind energy can enjoy the broadest popular support possible and make approvals for future projects faster and easier. Doing wind power the right way provides immediate and obvious benefits by protecting sensitive wildlife and key landscapes, but also benefits the wind industry by streamlining clean wind energy projects.

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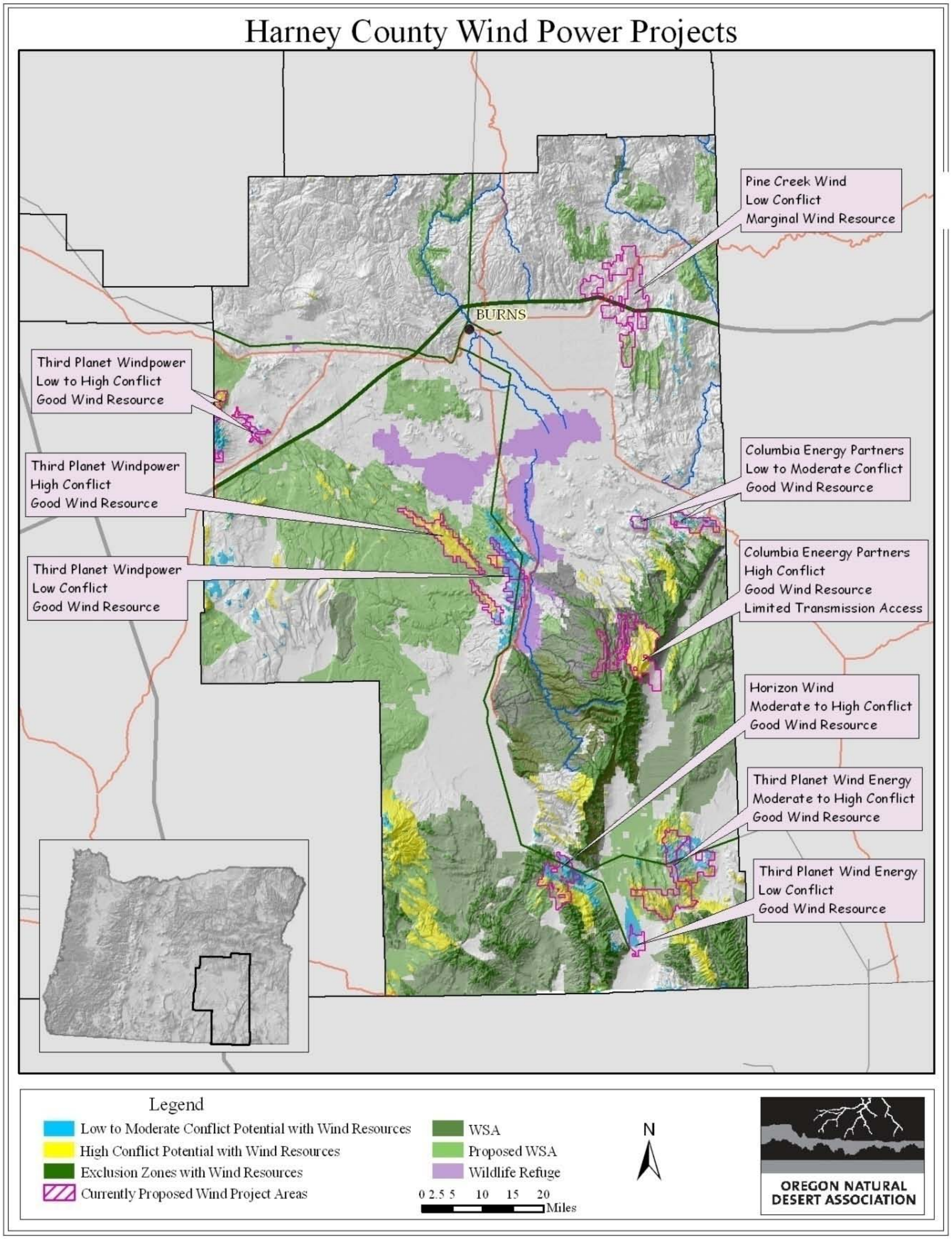
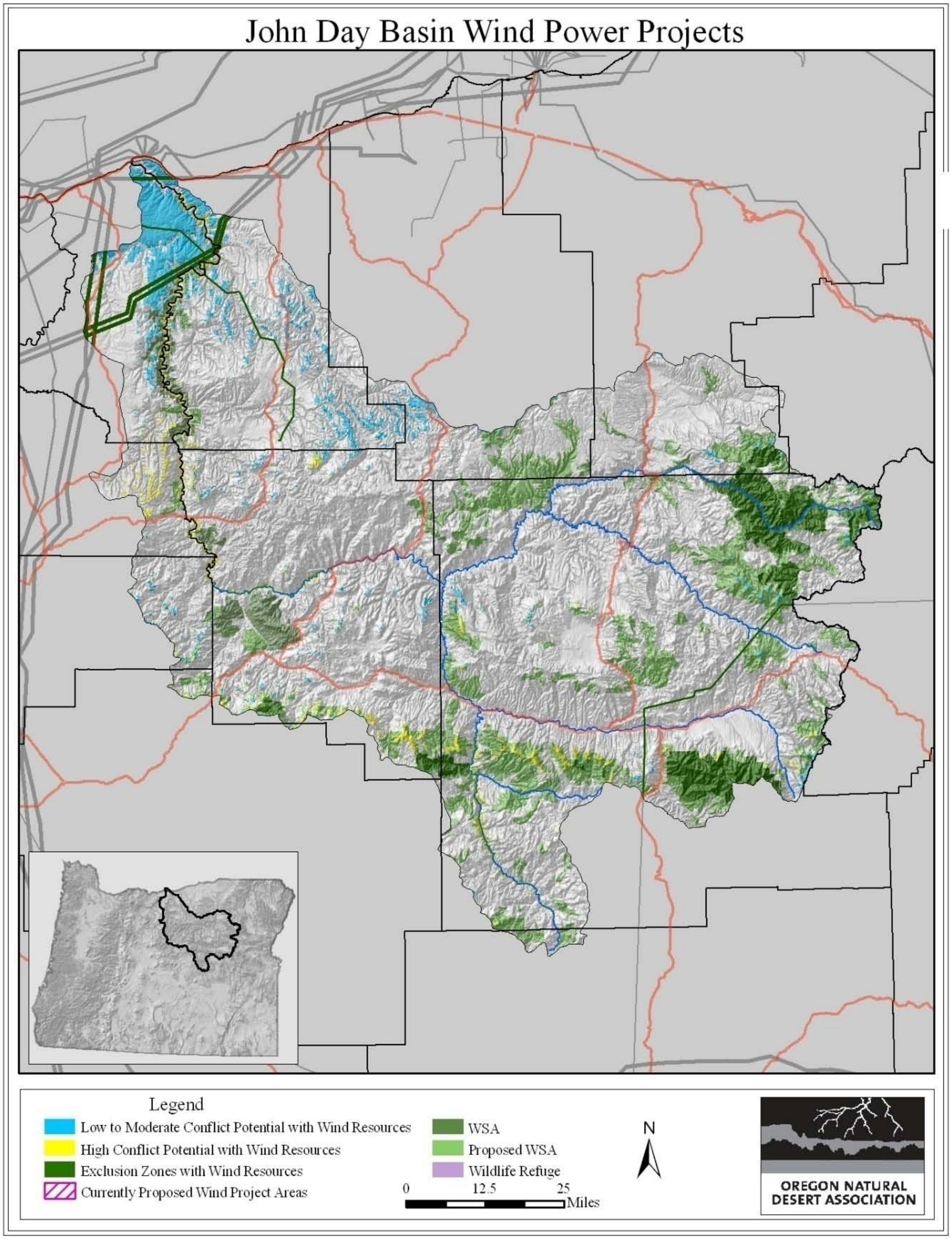
APPENDIX A - COUNTY MAPS


Harney County Wind Power Projects
BURNS
Pine Creek Wind
Low Conflict
Marginal Wind Resource
Third Planet Windpower
Low to High Conflict
Good Wind Resource
Third Planet Windpower
High Conflict
Good Wind Resource
Third Planet Windpower
Low Conflict
Good Wind Resource
Columbia Energy Partners
Low to Moderate Conflict
Good Wind Resource
Columbia Eneergy Partners
High Conflict
Good Wind Resource
Limited Transmission Access
Horizon Wind
Moderate to High Conflict
Good Wind Resource
Third Planet Wind Energy
Moderate to High Conflict
Good Wind Resource
Third Planet Wind Energy
Low Conflict
Good Wind Resource
Legend
Low to Moderate Conflict Potential with Wind Resources
High Conflict Potential with Wind Resources
Exclusion Zones with Wind Resources
Currently Proposed Wind Project Areas
WSA
Proposed WSA
Wildlife Refuge
N
0 2.5 5 10 15 20
Miles
OREGON NATURAL DESERT ASSOCIATION


John Day Basin Wind Power Projects
Legend
Low to Moderate Conflict Potential with Wind Resources
High Conflict Potential with Wind Resources
Exclusion Zones with Wind Resources
Currently Proposed Wind Project Areas
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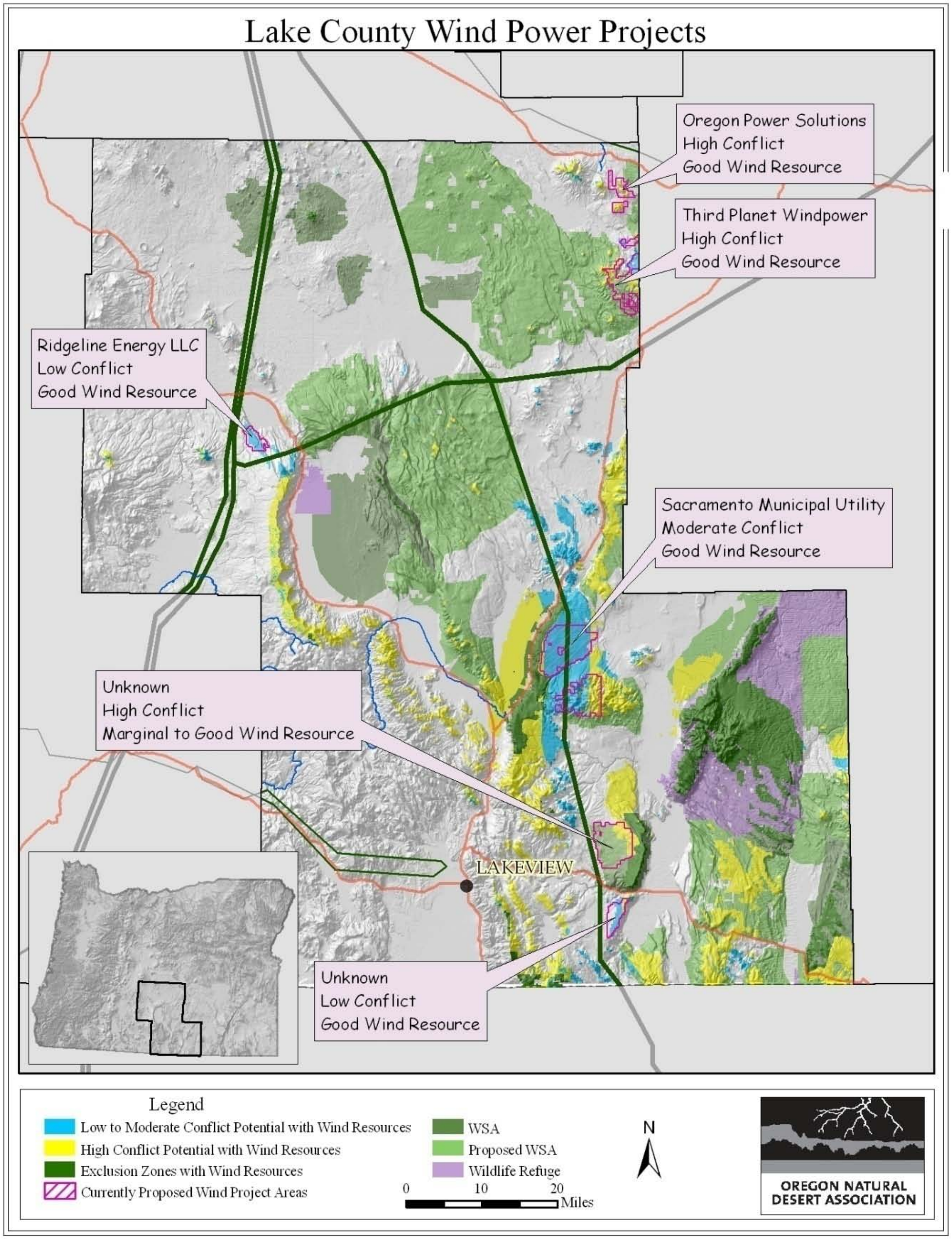
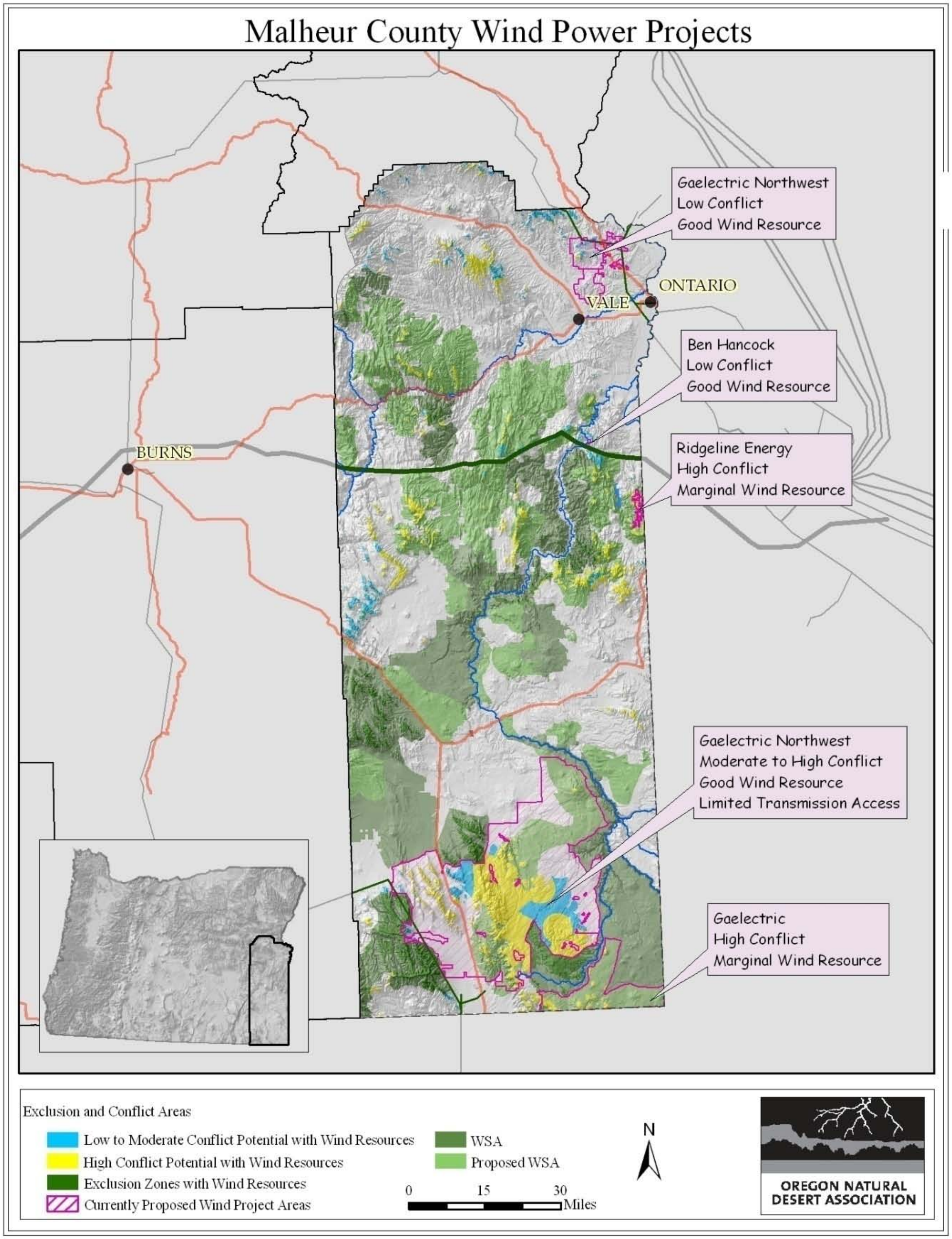
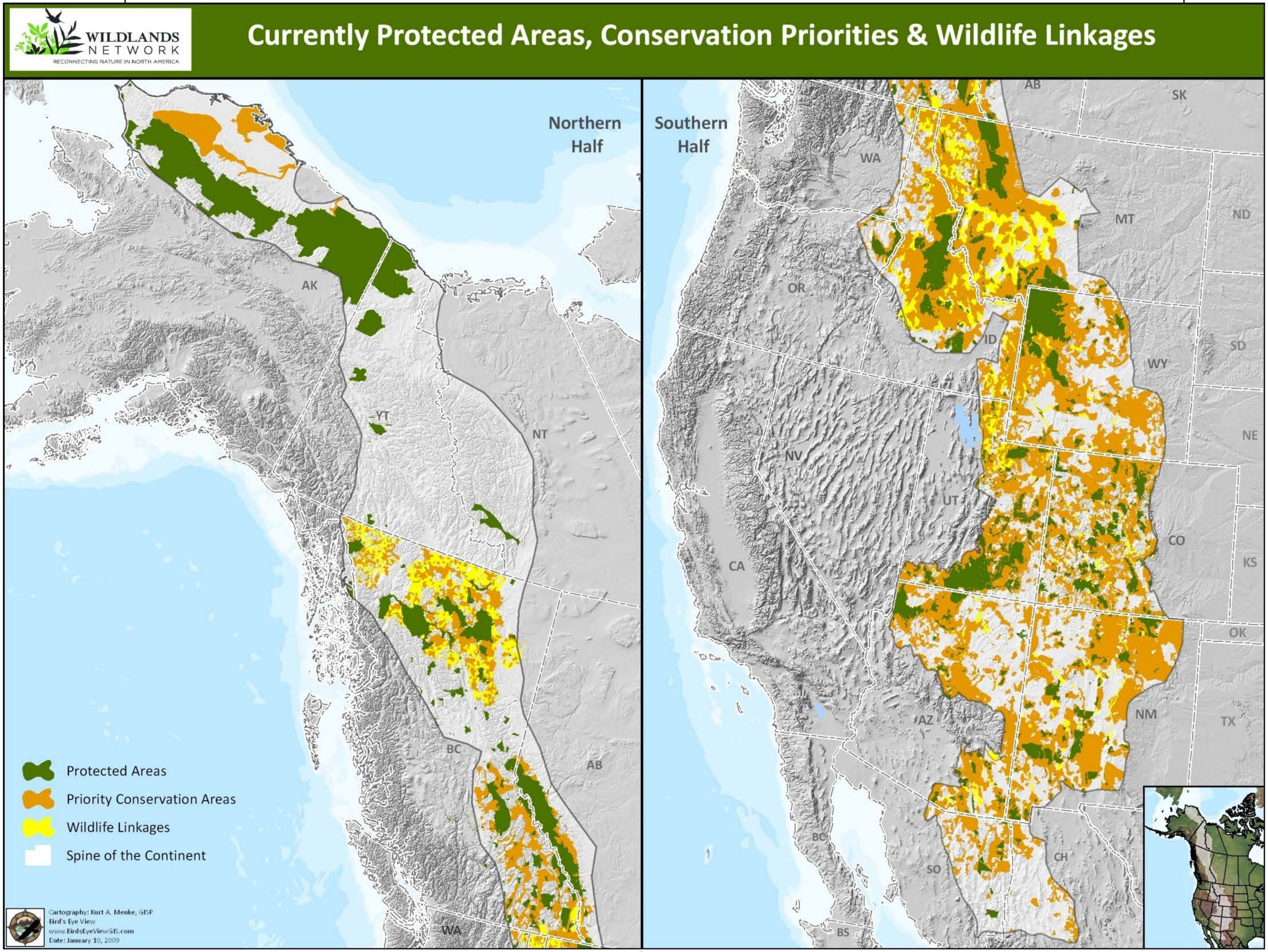
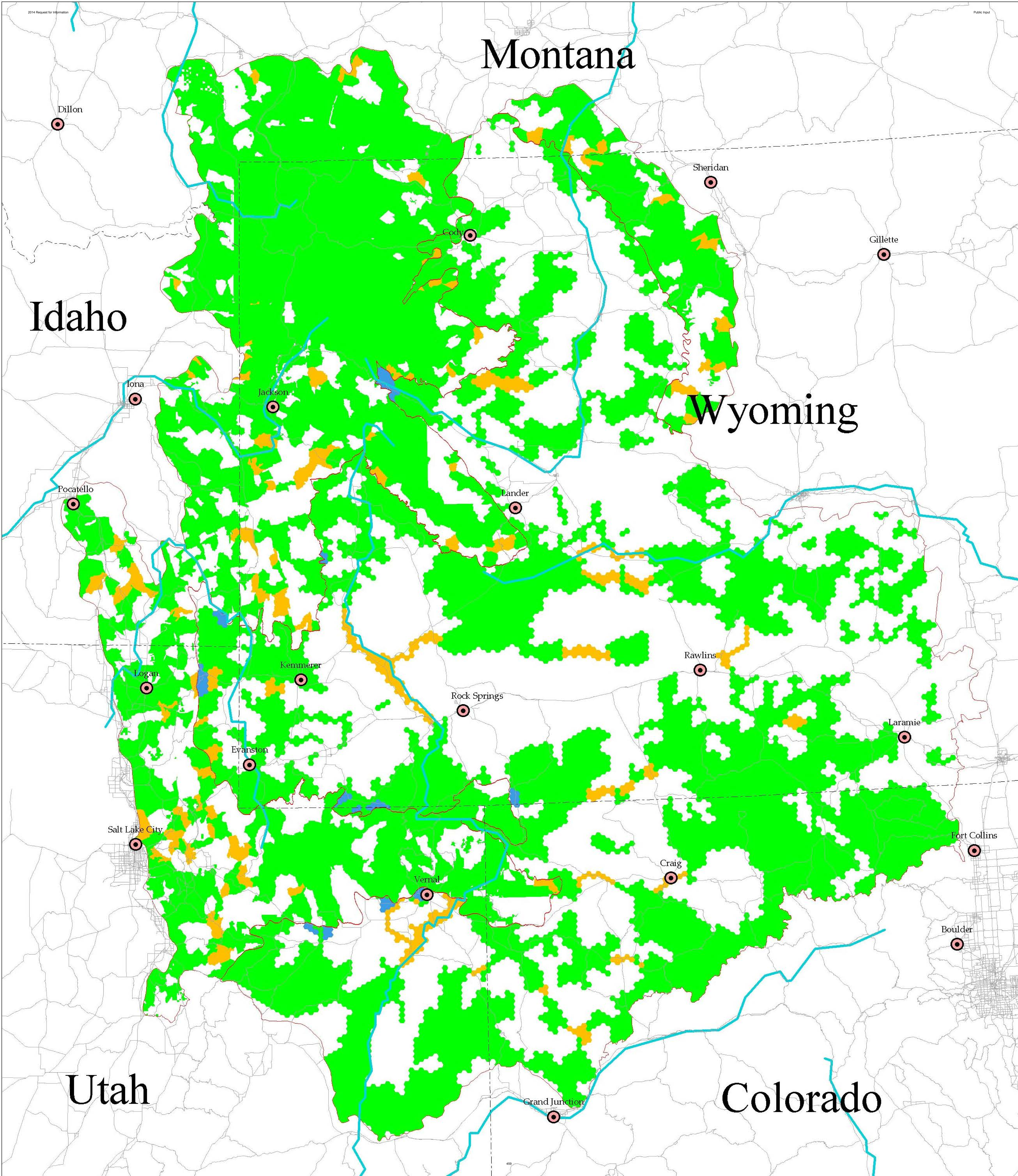
Proposed WSA
Wildlife Refuge
N
0
12.5
25
Miles
OREGON NATURAL
DESERT ASSOCIATION


Lake County Wind Power Projects
Oregon Power Solutions
High Conflict
Good Wind Resource
Third Planet Windpower
High Conflict
Good Wind Resource
Ridgeline Energy LLC
Low Conflict
Good Wind Resource
Sacramento Municipal Utility
Moderate Conflict
Good Wind Resource
Unknown
High Conflict
Marginal to Good Wind Resource
LAKEVIEW
Unknown
Low Conflict
Good Wind Resource
Legend
Low to Moderate Conflict Potential with Wind Resources
High Conflict Potential with Wind Resources
Exclusion Zones with Wind Resources
Currently Proposed Wind Project Areas
WSA
Proposed WSA
Wildlife Refuge
0 10 20 Miles
N
OREGON NATURAL DESERT ASSOCIATION


Malheur County Wind Power Projects
Gaelectric Northwest
Low Conflict
Good Wind Resource
ONTARIO
VALE
Ben Hancock
Low Conflict
Good Wind Resource
BURNS
Ridgeline Energy
High Conflict
Marginal Wind Resource
Gaelectric Northwest
Moderate to High Conflict
Good Wind Resource
Limited Transmission Access
Gaelectric
High Conflict
Marginal Wind Resource
Exclusion and Conflict Areas
Low to Moderate Conflict Potential with Wind Resources
High Conflict Potential with Wind Resources
Exclusion Zones with Wind Resources
Currently Proposed Wind Project Areas
WSA
Proposed WSA
0 15 30 Miles
N
OREGON NATURAL DESERT ASSOCIATION


WILDLANDS NETWORK
RECONNECTING NATURE IN NORTH AMERICA
Currently Protected Areas, Conservation Priorities & Wildlife Linkages
Northern Half
Southern Half
AK
YT
NT
BC
AB
WA
AB
SK
MT
ND
WA
OR
ID
WY
SD
NE
NV
UT
CO
KS
CA
OK
AZ
NM
TX
BC
SO
CH
BS
Protected Areas
Priority Conservation Areas
Wildlife Linkages
Spine of the Continent
Cartography: Kurt A. Menke, GISP
Bird's Eye View
www.BirdsEyeViewGIS.com
Date: January 10, 2009


Montana
Idaho
Wyoming
Utah
Colorado
Dillon
Sheridan
Cody
Gillette
Iona
Jackson
Pocatello
Lander
Rawlins
Logan
Kemmerer
Rock Springs
Laramie
Evanston
Salt Lake City
Fort Collins
Craig
Vernal
Boulder
Grand Junction

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Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*)

Open-File Report 2013–1098

U.S. Department of the Interior
U.S. Geological Survey

Cover photos: Greater Sage-Grouse, by Gary Kramer, U.S. Fish and Wildlife Service;
Tule Butte, east of Farson, Wyo., by Spencer Schell, Ecologist, U.S. Geological Survey.

Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*)

By D.J. Manier, D.J.A. Wood, Z.H. Bowen, R.M. Donovan, M.J. Holloran, L.M. Juliusson, K.S. Mayne, S.J. Oyler-McCance, F.R. Quamen, D.J. Saher, and A.J. Titolo

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U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
meter (m)	1.094	yard (yd)
	Area	
square meter (m^2)	0.0002471	acre
hectare (ha)	2.471	acre
square kilometer (km^2)	247.1	acre
square centimeter (cm^2)	0.001076	square foot (ft^2)
square meter (m^2)	10.76	square foot (ft^2)
square centimeter (cm^2)	0.1550	square inch (ft^2)
hectare (ha)	0.003861	square mile (mi^2)
square kilometer (km^2)	0.3861	square mile (mi^2)
	Mass	
gram (g)	0.03527	ounce (oz)
kilogram (kg)	2.205	pound (lb)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) using:
°F=(1.8×°C)+32

Horizontal coordination information (in map figures) is referenced to with World Geographic System (WGS 84) with an Albers Equal Area projection.

Acronyms and Initialisms Used in This Report

AFB	Air Force Base
AFMSS	Automated Fluid Minerals Support System BLM
AUM	animal unit month
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CCP	Comprehensive Conservation Plan
CIRO	City of Rocks National Reserve
CRMO	Craters of the Moon National Monument and Preserve
CRP	Conservation Reserve Program
DOI	Department of Interior
DPS	distinct population segment
FAA	Federal Aviation Administration
FRA	Federal Railroad Administration
FY	fiscal year
GIS	geographic information system
GSGCCS	Greater Sage-Grouse Comprehensive Conservation Strategy
GSSP	Geospatial Services Strategic Plan (BLM)
HMA	herd management area
ICBEMP	Interior Columbia River Basin Ecosystem Management Project
ID	identification
INL	Idaho National Laboratory
ISR	in situ recovery
LUP	land use plan
LWG	local working group
MOU	Memorandum of Understanding
MSF	master summary file
mtDNA	mitochondrial DNA
MW	megawatt
MZ	management zone
NASECA	North American Sagebrush Ecosystem Conservation Act (proposed)
NIFC	National Interagency Fire Center
NLCS	National Landscape Conservation System
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory

OHV	off-highway vehicle
PEIS	Programmatic Environmental Impact Statement
PGH	preliminary general habitat
PPH	preliminary priority habitat
SAFE	State Acres For Wildlife Enhancement
SGI	Sage-Grouse Initiative
SMA	surface management agency
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WAFWA	Western Association of Fish and Wildlife Agencies
WNv	West Nile virus

Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*)

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Executive Summary

The sagebrush biome, including sagebrush-steppe and Great Basin sagebrush communities, interspersed with grasslands, salt flats, badlands, mountain ranges, springs, intermittent creeks and washes, and major river systems, is one of the most widespread and enigmatic components of Western U.S. landscapes. One of its most charismatic species, the Greater Sage-Grouse, has been observed, hunted, and counted for decades. Habitat conversion, degradation, and fragmentation have accumulated across the entire range such that local conditions as well as habitat distributions at local and regional scales are negatively affecting the long-term persistence of this species. Historic patterns of human use and settlement of the sagebrush ecosystem have contributed to the current condition and status of sage-grouse populations. The current framework of multiple use (including industrial, agricultural, recreation, and other activities) has been imposed over a system that never fully recovered from the intense use prior to the Taylor Grazing Act (1934). Repurposing of the most productive sagebrush ecosystems (regions with deep, loamy soils, for example) for agriculture and urban development means that sage-grouse have already been marginalized on lands they share with domestic livestock, industry, herds of introduced horses and burros, and other sagebrush inhabitants. But in spite of the accumulation of odds against them, many small and large sage-grouse populations persist across the range, albeit population counts have steadily declined in past decades.

The accumulation of habitat loss, persistent habitat degradation, and fragmentation and perforation by industry and urban infrastructure, as indicated by U.S. Fish and Wildlife Service (USFWS) findings, presents a significant challenge for conservation of this species and sustainable management of the sagebrush ecosystem. Because of the wide variations in natural and human history across these landscapes, no single prescription for management of sagebrush ecosystems (including sage-grouse habitats) will suffice. However, specific activities that fall under the general categories of protecting the isolated pieces of intact and well-functioning sagebrush ecosystems, and improving, mitigating, and restoring less functional ecosystems, if well-informed, coordinated, and wide-ranging, should contribute to reducing the impacts of previous land uses and land-use patterns on current habitat conditions and population trends. Across the sage-grouse range, the impacts of extensive infrastructure are widespread, including roads, power transmission lines, pipelines, communication towers, and fencing, and localized human activities such as water retention and vegetation treatments have been recognized, but precise influences and remediation solutions are often not well understood. These activities interact with widespread, but generally less intense, pressures including large herbivores (domestic, introduced, and native ungulate populations) in determining range conditions. Range and habitat conditions may be improved, mitigated, and (or) regulated to reduce impacts and better balance the desires of land users with wildlife needs and conservation of public property and interests (lands and wildlife). Importantly, as recognized by Natural Resources Conservation Service (NRCS) Sage-Grouse Initiative (SGI) and others, continuing to improve habitat management is complementary to sound range management,

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and improving the composition, productivity, and resilience of sagebrush habitats should improve rangeland health for the benefit of all. Although a suite of direct mortality sources have been discussed and investigated, the evidence clearly suggests that critical aspects of population demographics, including nest success, brood-rearing success, predation risk, disease risk, hunting, and poisoning are only significant when habitat restrictions (that is, loss, fragmentation, and degradation) magnify their effects. Thus, concentrating on conservation and improved management of the sagebrush ecosystem as a solution for reducing the decline of sage-grouse requires the critical endorsement of the close relation between habitat availability, condition, and distribution with population fecundity. This relation is foundational in science and management of wildlife. The collective efforts of State wildlife management agencies and State and Federal land management agencies to improve range and habitat conditions, to the benefit of wildlife, public interests, and local landowners (especially public land lessees) are also based on this foundational relation. Current efforts are additionally complicated by evolving knowledge and changing roles of natural processes. For example, understanding of the relation between fire and sagebrush systems has evolved from a theory of purely negative effects to recognition of its importance as a natural process. Re-evaluations of preconceptions and continuing experimentation and observations indicate complicated relations between sagebrush and disturbances and imply a more irregular and lengthy interval between fires than previously described. Current understanding recognizes fire as a relevant tool, albeit with a potentially limited role in some systems, and certainly a complicated role in conserving the distribution and function of sagebrush ecosystems, due to interactions with other factors. Understanding and application of the natural role of fire in sagebrush ecosystems must be tempered by the realization that loss and fragmentation of mature sagebrush communities (given recent disturbance and land-use patterns) is a threat to sage-grouse conservation. Occurrence of large wildfires, often influenced by the distribution of cheatgrass, represents a direct threat to the successful conservation of those habitats and associated populations.

This report documents and summarizes several decades of work on sage-grouse populations, sagebrush as habitat, and sagebrush community and ecosystem functions based on the recent assessment and findings of the USFWS under consideration of the Endangered Species Act. As reflected here, some of these topics receive a greater depth of discussion because of the perceived importance of the issue for sagebrush ecosystems and sage-grouse populations. Though explicit connections to effects on sage-grouse populations are attempted throughout, these connections remain elusive and difficult to document. Understanding that perfect knowledge of these species and ecosystems is impossible due to natural complexity and human limitations, drawing connections between the direct effects on sagebrush ecosystems and the effect of ecosystem condition on habitat condition, and finally the connection between habitat quality and sage-grouse population dynamics remains the lofty goal of science and management. This effort is necessary and important, and despite the perception that these complicated, indirect relations are difficult to characterize and manage, many advances in understanding and application have been documented.

The distributions of habitats, species, and human land uses are notably heterogeneous across large landscapes, and understanding the relations and processes that create these patterns, including both positive and negative associations, will assist in long-term planning by helping to identify risks to habitat and resource conservation success, control and mitigate our activities to reduce impacts and insure resiliency, and protect and conserve our natural heritage and natural resources for future generations. Rather than any single source of habitat degradation, the cumulative and synergistic impact of multiple disturbances, continued spread and dominance of invasive species, and increased impacts of land use continue to have the most significant influence on the trajectory of sagebrush ecosystems and sage-grouse populations. Future patterns of land use, combined with *effective* restoration and management may improve, or degrade, the remaining sage-grouse ranges, but natural dynamics and unforeseen stochasticity promise to add complexity to future plans and landscapes.

I. Social and Political Overview and Introduction

Greater Sage-Grouse (*Centrocercus urophasianus,* hereafter sage-grouse) are large, ground-dwelling birds that reside primarily in sagebrush ecosystems which were, and still are in some respect, ubiquitous across the intermountain regions of western North America. Whereas human settlement of these lands has been slower and more sparse than in more naturally productive parts of the country, conversion to suit human purposes, development of energy and mineral resources beneath the surface, and a long history of dispersed (but sometimes intensive) uses such as domestic grazing and off-highway vehicles (OHVs) have contributed to widespread loss and decline of sagebrush habitat quality and associated wildlife populations, as documented herein. The estimated distribution of contiguous sagebrush habitats, prior to Euro-American settlement (Schroeder and others, 2003), was nearly twice that which is available today (fig. 1). Although early documentation is sparse and potentially biased, it is suspected that similar reductions in sage-grouse abundance have occurred at a continental scale (Schroeder and others, 2004). Sage-grouse population trends are variable across their distribution, and though some populations appear stable, population numbers show long-term declines collectively and in several regions (Connelly and others, 2004). Proximate reasons for population declines differ across the sage-grouse distribution, but ultimately, the underlying cause is loss of suitable sagebrush habitat (Connelly and Braun, 1997; Leonard and others, 2000; Aldridge and others, 2008), which contrasts with direct effects such as predation, hunting, or other incidental mortality (such as collisions).

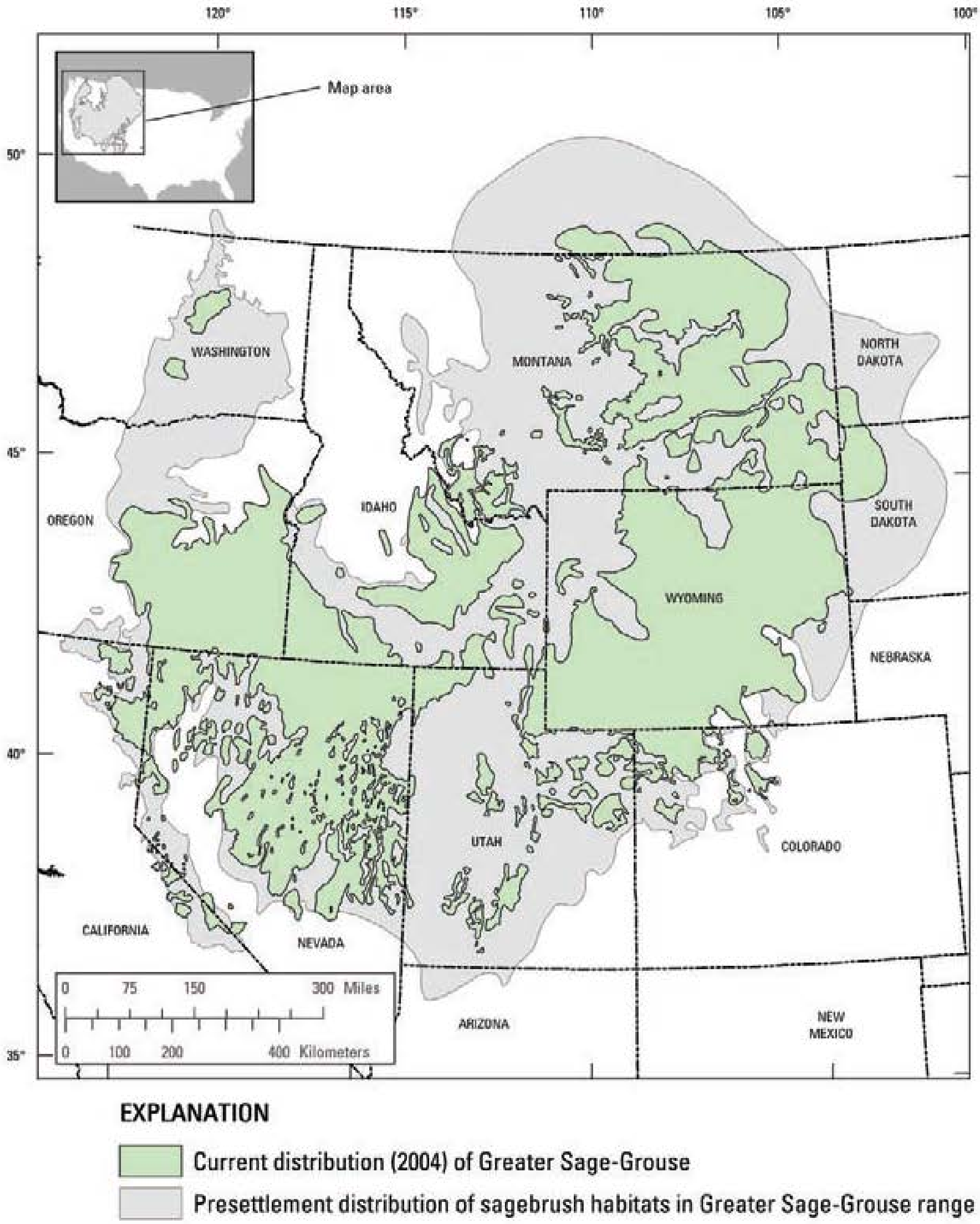

Figure 1. Current distribution (2004) of Greater Sage-Grouse and pre-settlement distribution of sagebrush habitats available for Greater Sage-Grouse across western North America.

Typically, variety in sagebrush-community composition (with variations in subspecies composition, co-dominant vegetation, shrub cover, herbaceous cover, and stand age) is necessary within the landscape to meet seasonal, and interseasonal, requirements for food, cover, and nesting of sage-grouse (Patterson, 1952; Connelly and others, 2000c). In this context, "the landscape" for sage-grouse encompasses large areas, roughly from 10s to 100s of square kilometers, to provide for multiple aspects of species life requirements, such as seasonal habitats (Beever and Aldridge, 2011; Connelly and others, 2011a,b; Leu, 2011). Thus, conserving and managing sage-grouse is as much about the ecology, management and conservation of large, intact sagebrush ecosystems as it is about the dynamics and behaviors of the bird populations (Connelly and others, 2004; Crawford and others, 2004). The large areas used by sage-grouse to meet seasonal habitat needs in these environments, coupled with the mixed land ownership patterns typically found across the west (fig. 2), dictates that a conservation strategy for the species will rely on cooperation across multiple Federal, State, local, and private parties. The basis of these cooperative conservation strategies requires understanding and mitigating the distribution of multiple threats that, in combination, reduce available habitat for sage-grouse.

Compounding the conservation challenge for governmental management agencies and private individuals alike, the sagebrush ecosystem is also important for the social and economic stability of the Western United States. Livestock grazing has been an important part of sagebrush ecosystems since the middle 1800s (Larson, 1978), and it continues to have important implications for the condition and management of these lands. Although grazing is critical for the economic and social structure of the region and an important contributor to the food supplies of the nation, the effects of grazing on public resources remain a contentious source of debate, research, and experimentation. Further, sagebrush rangelands have been steadily constricted by urban and exurban domestic development, mineral and energy industrial development, and a host of other land-use activities (and associated impacts) on surrounding natural areas (U.S. Fish and Wildlife Service, 2010b; Knick and Connelly, 2011b; Leu and Hanser, 2011). Thus, the balance between societal demands, natural capacity, and wildlife conservation is a fundamental component of sagebrush management, but this balance has not always been met. Accumulation of direct and diffuse disturbances has led to limitations in sagebrush systems, as habitats, due to degradation of local shrub and grass cover, diminished size of habitat patches, and wide dispersion of high-quality, seasonal habitats. This indicates that proximity and juxtaposition of habitat patches, as well as condition of the matrix, affect travel effort and mortality risks between habitats and overall habitat quality (Miller, 2011; Knick, 2011).

The multiple-scale attributes of sage-grouse habitat requirements make the current and historic roles of fire and other surface disturbances (for example, roads, industrial developments, agricultural conversion, and habitat treatments) important for monitoring and manipulation at regional scales as plans to manage for functional sagebrush ecosystems are implemented. Though wildfires likely played an important role historically in creating a mosaic of herbaceous dominated areas (recently disturbed) and mature sagebrush (less frequently disturbed), current and historic land-use patterns have defined a new mosaic that has restricted systemic ability to support wildfire regimes. Slow rates of growth and recovery of vegetation after disturbances (driven by low water availability and other environmental constraints) coupled with high rates of disturbance and conversion are largely responsible for the accumulating displacement and degradation of the sagebrush ecosystem, including natural disturbance regimes and patch dynamics that characterized historic landscapes (Christensen, 1985; Pickett and White, 1985).

Finally, the basins where most sagebrush ecosystems reside are also the center of major oil and gas reserves (for example, Denver, Eastern Great, Green River, Niobrara, Powder River, Uinta-Piceance, and Williston Basins), which have a long history of industrial use, particularly on eastern portions of the range, especially Management Zones (MZs) I, II, and VII. The intensity of new energy development has varied through time due to various factors including economics, technology, and national policy, but accumulation of roads, pads, wells, and other infrastructure has greatly outpaced their removal. Current national energy policies and demand for domestic oil and gas indicate that removal and reclamation of these resources will remain an important aspect of multiple-use land management, including habitat and wildlife management, into the future. In addition, national emphasis on "renewable" resource development adds pressure to develop wind, solar, and geothermal energy facilities. Although research on direct effects of these developments on wildlife is still underway, as described here, recognition that these developments alter, degrade or entirely displace native ecosystems is ubiquitous as the basic set of impacts (roads, traffic, equipment noise, and lights) are common among industries.

Imposition of modern land-use pressures on native ecosystems leads to direct habitat loss and habitat degradation. Even without added anthropogenic pressures, ecosystems are balanced between changing environmental conditions and demands for ecosystem services from people *and* wildlife such as clean water, abundant forage and prey, and domestic habitat. According to recent estimates, this combination of influences is tipping the scale, placing the sage-grouse on the verge of Federal listing under the Endangered Species Act (currently classified as "warranted, but precluded").

In the last decade, concern for the species prompted a series of petitions to list the sage-grouse under the Endangered Species Act (Stiver, 2011). The details of these petitions are well documented (U.S. Fish and Wildlife Service, 2010b; Stiver, 2011). More recently, on March 23, 2010, the USFWS released its 12-Month Findings for Petitions to list the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered ("2010 Listing Decision"; U.S. Fish and Wildlife Service, 2010b). In the 2010 Listing Decision, the USFWS concluded that listing the sage-grouse (rangewide)

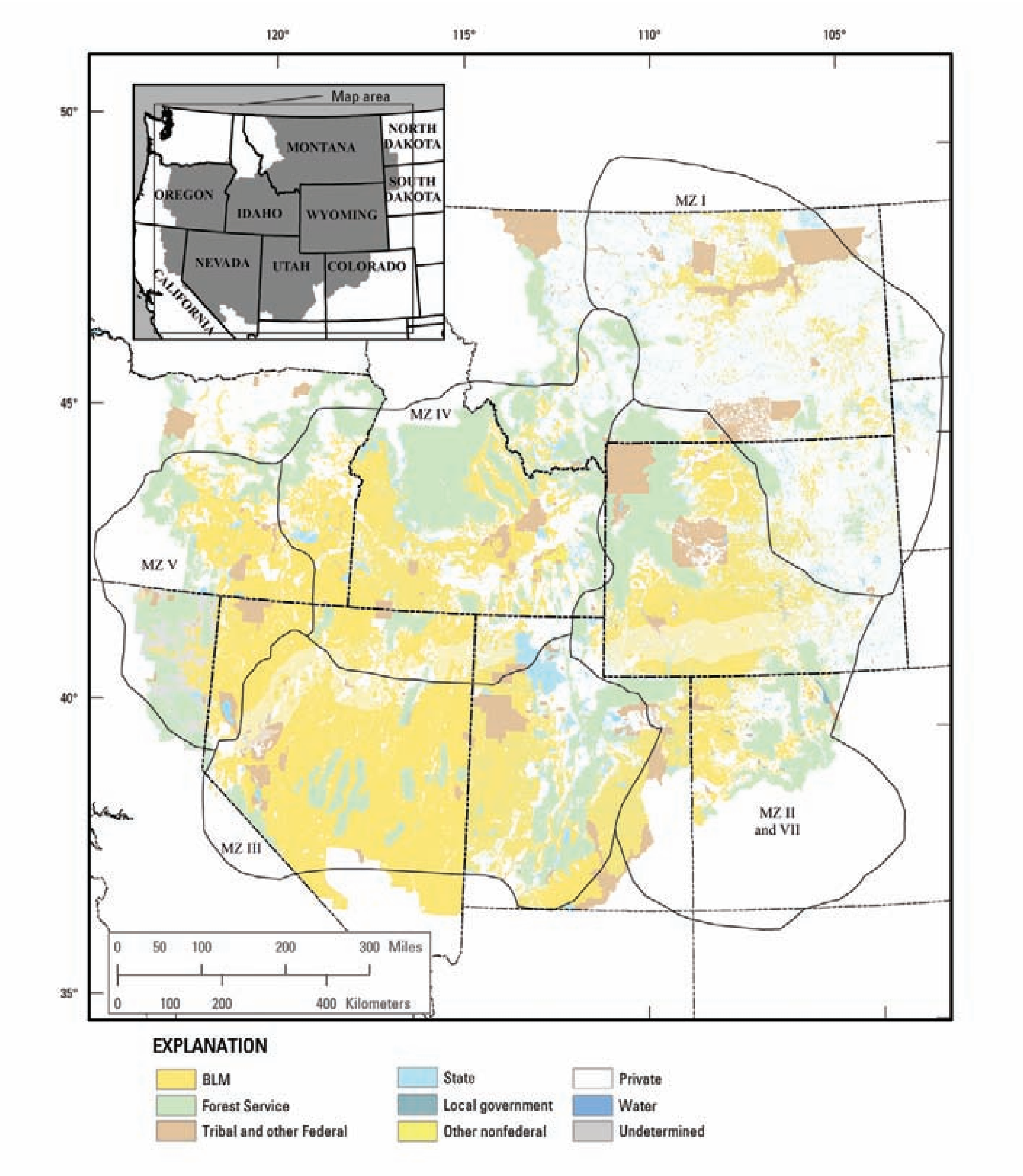

Figure 2. Land ownership or management jurisdiction across sage-grouse Management Zones (MZ). Note that small parcels and many details are omitted from a map of this resolution, in particular, private lands will appear underrepresented. This representation is for explanatory purposes only; it does not imply or infer any legal or other designation, re-designation, ownership rights or right-of-way.

was warranted, but precluded by higher priority listing actions (U.S. Fish and Wildlife Service, 2010b). The listing decision focused on two factors: (1) habitat fragmentation and degradation and (2) inadequate regulatory mechanisms. The USFWS will continue to annually evaluate changes to listing factors and update listing decisions regarding sage-grouse; however, the current urgency (time line) has been dictated by a work plan developed in response to a series of court approved settlement agreements (Judge Emmet Sullivan, U.S. District Court, Washington, D.C., September 9, 2011). Through these agreements and the plan, the agency agreed to make a final listing decision regarding the status of the sage-grouse by the end of fiscal year 2015. (Legal documentation and the work plan are available at *http://www.fws.gov/endangered/improving_ESA/listing_workplan.html*.) Under the terms of the settlement agreements, the USFWS must either determine that sage-grouse are warranted for listing and publish a proposed rule implementing that listing *or* make a not-warranted finding ("warranted, but precluded" will not satisfy legal agreements).

Building upon local working groups and interagency agreements, State and Federal land and wildlife management agencies are developing coordinated conservation strategies to secure the long-term future of the sage-grouse; unprecedented actions aimed at revising management and conservation so that listing (of the sage-grouse under the Endangered Species Act, ESA) is not necessary due to improved regulatory mechanisms providing for long-term sustainability of the species without further regulation. In direct response to concerns over regulatory mechanisms across the sage-grouse range, which transcend local, State, and Federal boundaries, these same entities are engaged in revising population conservation strategies, land management regulations, and management plans. This report provides a critical information source to these efforts by collecting and summarizing the scientific information important for understanding the impact of threats to sage-grouse and the spatial juxtaposition, and therefore relative magnitude of these issues, across the west and for different conservation partners. The primary focus is twofold; it should (1) inform the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) Greater Sage-Grouse Land Use Planning Strategy (Bureau of Land Management, 2011a) with consistent assessment and application of the most recent information and understanding regarding sage-grouse and their habitats, and (2) it should provide a quantitative summary of identified threats to establish a foundation for understanding and managing these impacts at biologically meaningful scales (such as, the Western Association of Fish and Wildlife Agencies, WAFWA, Management Zones). It will be important to address cumulative and interactive impacts of multiple disturbances and impacts in these planning efforts because they have been found, individually and in combination, to contribute to the decline of sage-grouse habitats (Connelly and others, 2004; U.S. Fish and Wildlife Service, 2010b; Connelly and others, 2011d). This summary assessment, along with associated analyses and applications, describe the environmental conditions and characterize the legal, natural resources, and human perspectives at a regional scale to help inform the large-scale context required for planning efforts.

A National Strategy

The National Greater Sage-Grouse Land Use Planning Strategy represents a planning framework and process to incorporate effective regulatory mechanisms (conservation measures) into Land Use Plans (LUP), especially BLM Resource Management Plans (RMP) and USFS Forest Management Plans (FMP), across the range of the sage-grouse (Bureau of Land Management 2011c, 2012). The strategy includes review of existing regulatory mechanisms and revision of these as necessary to conserve and restore the sage-grouse and their habitats on USFS- and BLM-administered lands across the species' range and to ensure these measures are carried forward into future planning efforts on the public lands. This planning framework includes the following elements:

- The need for science-based objectives, measures, and LUP decisions,
- The need for common data and regional perspectives to support local and regional cumulative impacts analyses,
- Consistency across jurisdictional boundaries and within defined ecoregional areas,
- The principal threats identified by the USFWS within different portions of the range, and
- Objectives expressed by the USFWS and WAFWA directives.

This approach articulates a structure and process capable of responding to national policy as well as the different ecological attributes and threats within regions by dividing the range into two broad regions—Great Basin and Rocky Mountains. As envisioned, each region develops a separate but similar planning strategy based on a cooperative planning effort with State wildlife management agencies and the USFWS. Information in this report is expected to support and inform the planning approach for these five elements of the National Planning Strategy. The primary focus of the planning effort, and hence this report, is Greater Sage-Grouse (*Centrocercus urophasianus*). The Gunnison Sage-Grouse (*Centrocercus minimus*), Greater Sage-Grouse Bi-State Distinct Population Segment (DPS), and Greater Sage-Grouse Columbia Basin DPS will be addressed in separate planning efforts and therefore are outside the scope of this report (Bi-State Local Planning Group, 2004).

This report is focused on providing support and regional consistency among these functional planning and implementation units through compilation, assessment and summary of data, and information from across the species' range (East and West). Rangewide and subregional distributions were the subject of targeted geospatial analyses to facilitate assessment of cumulative effects of development and other land uses beyond typical planning-unit boundaries. By compiling and summarizing data and technical literature that represent and address resource distributions, conservation units, potential threats, and other factors affecting the health and distribution of sage-grouse populations and habitats, it is anticipated that a common understanding may be carried forward by local working and planning groups.

Purpose and Suitable Application of This Report

Because of their broad range, variations in population traits and characteristics across this range, and the variability in habitat conditions and threats within this range, conservation of sage-grouse is a unique challenge compared to isolated or range-restricted species, primarily due to the scale of the effort. This complexity is increased because sage-grouse have habitat requirements that can be recognized at multiple scales with the broadest transcending traditional management boundaries. An area has suitable habitat if it (a) is large with contiguous acres of sagebrush; (b) contains a mosaic of sagebrush, grass, and forb cover, which provides suitable cover and forage opportunities (good condition) within proximity to allow seasonal movement and use; (c) contains healthy, productive, and sufficiently isolated (safe) local habitats that provide specific seasonal requirements, such as sagebrush, grasses, forbs *and* insects in spring-summer and sagebrush without snow-cover in winter; and (d) has sufficient specific microsite conditions that provide daily needs such as nest sites. Similarly, planning for conservation and management occurs at multiple scales.

Current efforts to prioritize areas across the range for conservation have focused on identifying large expanses of sagebrush for protection (casting a broad net to protect sagebrush ecosystems) or specifying regional expanses based on the “core areas” concept based on breeding density of the birds (numbers of males on leks; Doherty and others, 2010c). The National Greater Sage-Grouse Land Use Planning Strategy focuses at these broader scales; therefore, to accomplish this assessment, local details, for example the amount of shrub canopy, which vary in space and time, are necessarily grouped and averaged within map units (grid-cells or shapes) precluding fine-scale evaluation. However, regional trends and patterns that develop during periods of years may be recognized and highlighted at scales useful for assessment, planning, and management processes. This document is designed to inform and advance large-area, regional conservation efforts by consolidating information regarding rangewide and regional information about sage-grouse populations and habitats and to act as a bridge between these large-area efforts and regional and local management efforts (that is, forest and range management plans) by providing spatial and information context.

Delineation of Preliminary Priority and General Habitats

BLM national policy during the last decade has also focused on delineation and protection of large expanses of sagebrush with high densities of sage-grouse. In 2008, the BLM directed field and State offices to prioritize “key habitat areas” (large expanses of sagebrush) for protection from wildfire (Bureau of Land Management, 2008). Similarly a core-area strategy was proposed in the eastern portion of the range to help delineate landscape planning units by distinguishing areas of high biological value based on location of important breeding areas to help balance habitat requirements with demand for energy development (Doherty and others, 2011b; State of Wyoming, 2011). This core area method was adopted by many State fish and wildlife agencies who used Statewide breeding-bird data supplemented by local knowledge and interpretation to delineate habitat areas, for example Wyoming’s Core Areas (State of Wyoming, 2011). The Doherty approach was expanded by the BLM rangewide to create a Breeding Bird Density Map—across the range of the sage-grouse where the highest densities of breeding males were found on leks (Doherty and others, 2010c). Currently, the rangewide map has also been applied by the U.S. Department of Agriculture (USDA) through the NRCS to guide the SGI in prioritization of conservation actions on private lands within the sage-grouse range (Natural Resources Conservation Service, 2011). In an effort to consistently identify highly valuable areas that combine habitat-quality and bird-density approaches to identification and delineation, BLM has adopted “Preliminary Priority Habitat” (PPH) and “Preliminary General Habitat” (PGH) maps; these determinations and products were created cooperatively with State fish and wildlife agencies (Bureau of Land Management, 2011b). PGH and PPH are mutually exclusive habitat classes. PPH represents the habitat designated to maintain distribution and sustainable sage-grouse populations. PGH represents additional sage-grouse habitat with smaller populations, current or imminent threats, or other factors that affect management and conservation opportunities, which may be managed for habitat conservation and (or) restoration based on needs for connectivity, potential for restoration, or other local issues (fig. 3). This approach combines both the bird density and valuable habitat approaches and adopts State-agency knowledge and perspectives to identify the seasonal habitats needed for sage-grouse persistence. It represents a collective of biological, socioeconomic, and management understanding combined to identify areas that need assessment of threats for amelioration or protection, regulatory enforcement mechanisms, monitoring of sage-grouse population trends, and adaptive management as needed, and it should complement, not replace, locally specified priorities when these are aligned with regional issues (Conservation Objectives Team and others, 2013). This cooperative approach identified habitat across 10 States utilizing a planning process that extended across multiple jurisdictions. Ongoing applications through the land-use planning

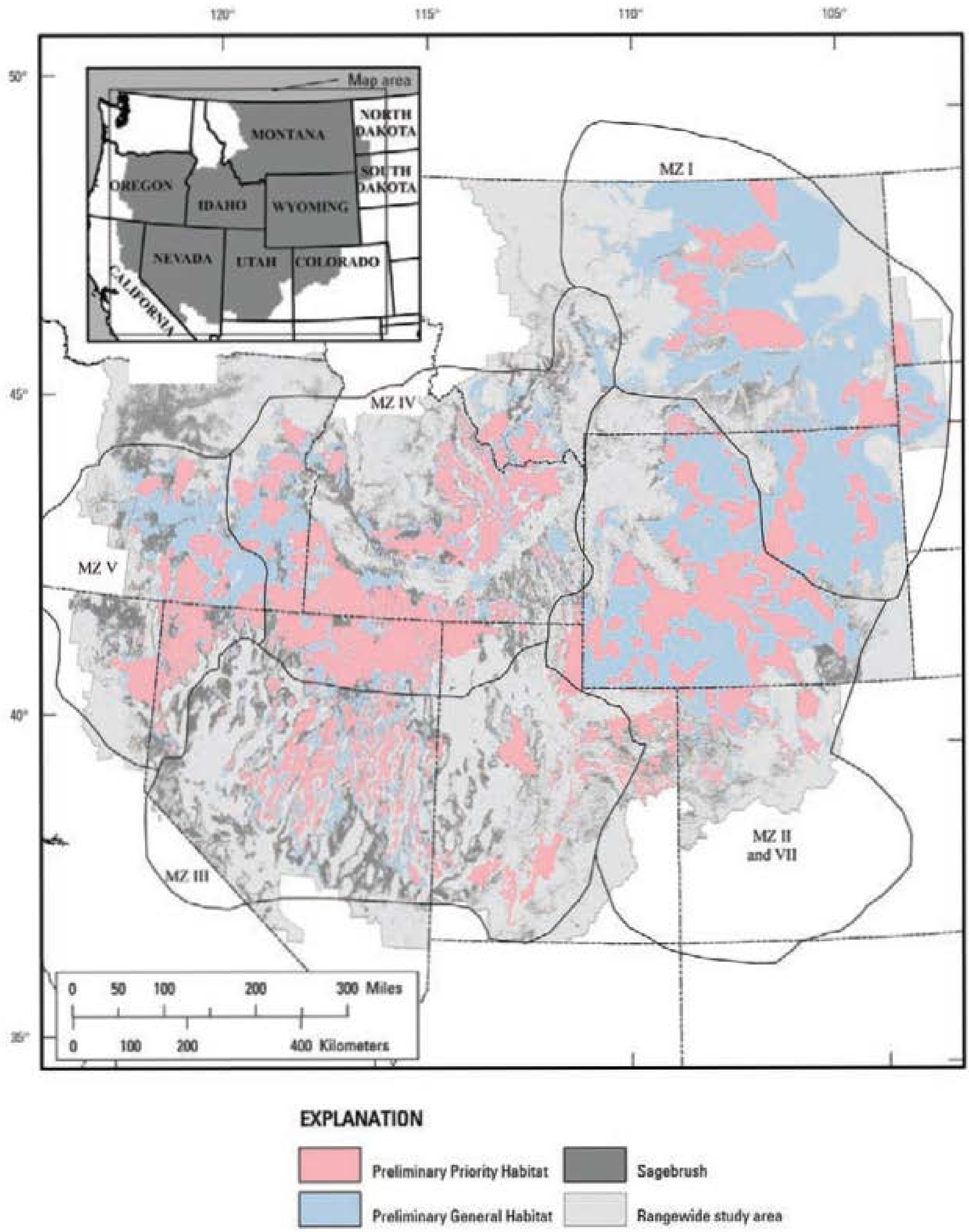

Figure 3. Distribution of preliminary priority habitat and preliminary general habitats (PPH and PGH, respectively) displayed with additional (current) distribution of sagebrush.

process, especially BLM and USFS, may refine PPH and PGH to (1) improve and update Priority Habitat area definitions, (2) analyze actions within Priority Habitat areas to conserve, or improve, sage-grouse habitat functionality, (3) formally recognize General Habitat areas and assess habitat condition and use in these areas, and (4) analyze actions within General Habitat areas that affect the ability of the system to provide important sage-grouse functional requirements (such as suitability for breeding, migration, or winter survival).

Because of the different objectives for priority and general habitat, this report uses the current PPH and PGH delineations (as defined, June 26, 2012) to characterize the relative magnitudes and locations of threats within current management, planning, and assessment units. Potential applications include identification of local habitats within a regional context of PPH and PGH, understanding the distribution of threats within PPH and PGH areas, providing spatial context such that priority habitat can be delineated or adjusted, and management actions can be devised to meet conservation and management objectives.

Geospatial Analysis Methods

Geospatial data were acquired for all threats identified in the USFWS listing decision that can be represented spatially. These data were acquired rangewide, as available, from both internal (BLM and USFS) and external sources beginning in August 2011 (see appendix). All data, both internal and external, were considered the “best available” at the time of data collection. National dataset collection stopped in July 2012 (although verification and adjustments of some of the datsets continued through December 2012), whereas other data (for example, compiled from other sources) were the most current available based on the supplying office, agency, or organization. Internal data were compiled using intra-agency data calls and often included data submitted in segments from different administrative units across the BLM and USFS management areas. These datasets were aggregated and reviewed, but time constraints limited the ability to revise these data for quality and completeness, such as properly addressing all geometry errors (gaps and overlaps) and edge-matching across jurisdictions. After data collection was complete, input datasets were preprocessed. Preprocessing steps included reclassification, attributing, buffering, and other formatting tasks. Categorizing datasets into relevant attributes and supplementing them with additional attributes was necessary for data compatibility. Buffers were developed based on area-of-influence distances provided in peer-reviewed literature to represent direct (footprint) and indirect (buffer distances ranging from 1.5 to11.8 mi [2.5–19 km]) effects on sage-grouse populations. (Also, see Appendix A-1.) Collaboratively developed priority habitat designations (PPH and PGH) were combined with surface management responsibilities and WAFWA Management Zone polygons into one master summary file with a unique identifier reflecting the specific combination of habitat, surface management, and MZ for each polygon to provide for efficient, repeatable, and consistent data summaries. Finally all datasets were clipped to the rangewide study area, and small or superfluous polygons were dissolved to reduce the number of features and remove unnecessary attributes. Finally, data was sorted into point, line, and polygon features for different analyses that reflected the footprint and effects representation.

Overlay comparisons were generated using ArcGIS Model Builder (version 10.0) with separate models created for point, line, and polygon input data (see appendix for details). In brief, these models intersected the input data with the master summary file, which included representation of the spatial summary units (MZs, and so forth), and dissolves extra boundaries based on the unique identification assigned in the intersection. Finally, summary data were calculated for each threat overlay using the number of points, linear miles, or area within the specific combination of habitat type, land management, and MZ. Attribute data were exported to spreadsheets for summary calculations.

Key Assumptions and Limitations

The data and information included here are the most accurate available; however, these data and associated risk assessments remain based in present knowledge. Simulation of future conditions was not a component of this assessment, and these data are not predictions of future events or conditions. Spatial data informing these analyses were compiled to establish a consistent information and analytical basis across the entire region (Sage-Grouse Management Area), but in order to attain this consistently across State, ownership, and management boundaries, some local details have been omitted. As such, these data and analytical approaches provide a regional assessment tool suitable for guiding regional mid- to long-term planning scenarios over broad spatial scales. Local expertise and data are needed to complement these landscape data when developing specific management plans using these regional guides.

Because of the scale of summary and the existence of other guiding documents, this report was developed to play a particular role in organizing and assessing the character and distribution of threats to the persistence of sage-grouse. Data and summary information were compiled rangewide providing sufficient resolution to address relative distribution and magnitude of effects within the seven sagebrush Management Zones (MZs) defined to support sage-grouse conservation planning, but these may require local supplementation. Within these Management Zones, current delineations of PPH and PGH cross management entities and represent Federal and State perspectives on the areas needed to maintain sustainable populations and the areas to evaluate to maintain connectivity between these populations (see tables for summary statistics representing PPH and PGH by Management Zone and entity). For the purposes of this report, focus on the Greater Sage-Grouse (without the Bi-State and Columbia Basins populations) includes BLM and USFS units within sage-grouse range. The study area roughly follows the Management Zone boundaries, but limits analyses to overlapping areas within specific planning unit boundaries (fig. 3). Therefore, this assessment concentrates on currently occupied habitats and uses slightly different delineations than found in previous, related works (for example, Stiver and others, 2006; Knick and others, 2011). The natural and human processes of interest are active across multiple spatial-temporal scales; therefore this assessment necessarily includes topics and discussion that cross between national-, regional-, and local-level planning and implementation. However the primary goal of this report is to provide broad-scale perspective (in data and literature), which may be combined, subsequently, with local knowledge and directives to develop specific forest and resource management plans.

II. Populations, Distributions, Trends, and Natural History

Species Description and Taxonomy (Rangewide)

Sage-grouse (*Centrocercus* spp.) are the largest grouse found in North America. They are a ground-dwelling, sagebrush-obligate species. Historically, sage-grouse were considered to be one species with a pre-settlement range that included 14 U.S. States and 3 Canadian Provinces (fig. 1; Aldrich, 1963; Johnsgard, 1983; Connelly and others, 2004; Schroeder and others, 2004). In 1946, Aldrich described two subspecies, an eastern (*C. u. urophasianus*) and western sage-grouse (*C. u. phaios*) based on slight color differences in 11 individuals collected from Washington, Oregon, and California (Aldrich, 1946). In the 1990s, research in southwestern Colorado revealed morphological (Hupp and Braun, 1991) and behavioral (Young and others, 1994) evidence suggesting that the sage-grouse in southwestern Colorado and southeastern Utah were distinct from sage-grouse elsewhere across their range and might be a new species. Genetic data (Kahn and others, 1999; Oyler-McCance and others, 1999) revealed patterns consistent with a lack of gene flow between sage-grouse in southwestern Colorado-southeastern Utah and northern Colorado, which supported the idea that this group of sage-grouse was a different species. In 2000, the American Ornithologists' Union recognized the formal description of this group of sage-grouse as a new species, named Gunnison Sage-Grouse (*C. minimus*; Young and others, 2000). All other sage-grouse were subsequently renamed Greater Sage-Grouse (*C. urophasianus*).

This reassessment of sage-grouse taxonomy spurred a reexamination of the subspecies classification of the sage-grouse. The geographic delineation separating the eastern and western subspecies is ambiguous and has changed through time (Aldrich, 1946; Aldrich and Duvall, 1955; American Ornithologists' Union, 1957; Aldrich, 1963). Morphological comparisons by Schroeder (2008) revealed slight variations among individuals and some populations, yet the magnitude of the differences were not sufficient to be recognized as distinct subspecies using current taxonomic standards, and the patterns of variation were not consistent with geographically described subspecies. Schroeder (2008) and Taylor and Young (2006) both examined strutting behavior and did find some regional differences, but those differences were inconclusive in distinguishing the purported eastern and western subspecies. Genetic data (using both mitochondrial and nuclear genetic markers) collected from individuals across the range were not differentiated at the subspecies boundary (Benedict and others, 2003; Oyler-McCance and others, 2005b), yet a population that spans the border between California and Nevada (Bi-State population) was found to be unique genetically. This Bi-State population, although genetically unique, does not appear to have obvious morphological or behavioral differences as was seen in the Gunnison Sage-Grouse (Taylor, 2006; Schroeder, 2008). Though the taxonomic status of the Bi-State population has been widely debated, no formal taxonomic change regarding this population has been made. Additionally, the U.S. Fish and Wildlife Service no longer considers listing consideration at the subspecies level based on the multiple lines of evidence that do not support the eastern and western subspecies delineation in sage-grouse.

Population Distribution and Trends—Including Subpopulations and Management Zones

The current range of sage-grouse includes 11 U.S. States and 2 Canadian provinces (fig. 1) and is thought to be a reduction of 44 percent from the pre-settlement range (Connelly and Braun, 1997; Schroeder and others, 2004). Although specific reasons for population decline differ across the range, the underlying cause is the loss, degradation, and fragmentation of suitable sagebrush habitat (Connelly and Braun, 1997; Leonard and others, 2000; Aldridge and others, 2008). As sagebrush habitats increasingly overlap with natural resources (for example, oil, gas, wind, minerals, agriculture, and recreation areas) and face increased landscape-level changes caused by invasive plants, fire, and conifer encroachment (Connelly and others, 2004), populations have declined substantially raising conservation concern for the species.

The broad distribution of sage-grouse encompasses a diverse collection of environments with an equally varied assortment of ecological pressures. Therefore, management practices and conservation strategies are often quite dissimilar in different portions of the range (Stiver and others, 2006a). To facilitate development of management and conservation actions that are more consistent within ecological regions, instead of political boundaries, the sage-grouse range was divided into seven sage-grouse Management Zones based on similarities in geography, climate, topography, and floristics (West, 1983; Miller and Eddleman, 2000; Connelly and others, 2004; Stiver and others, 2006a; fig. 2).

Sage-grouse MZ I includes seven sage-grouse populations on the northwestern Great Plains (Connelly and others, 2004) in parts of Montana, Wyoming, North Dakota, South Dakota, Saskatchewan, and Alberta (fig. 3 and table 1). Three of these populations are considered large and are loosely connected to adjacent populations (Connelly and others, 2004). The Wyoming Basin (MZ II) consists of 13 populations covering parts of Montana, Wyoming, Colorado, Idaho and Utah. Three populations are considered to be large and connected to adjacent populations (Connelly and others, 2004), and the Wyoming Basin proper includes five subpopulations that are perceived to be well connected. Management Zone III represents the Southern Great Basin and consists of 13 populations in parts of California, Nevada, and Utah. Only two of these populations have been described as large (table 1; Connelly and others, 2004). The Mono Lake (Bi-State Local Planning) population is included in MZ III; however, that Distinct Population is being addressed through a separate planning process involving California and Nevada working groups. The Snake River Plain and associated drainage basins characterize MZ IV; this region includes 14 sage-grouse populations in Oregon, Montana, Idaho, Nevada, and Utah, and two of these populations are considered to be large (Connelly and others, 2004). Management Zone V consists of five populations in the Northern Great Basin. These populations are found in Oregon, California, and Nevada. The Lake Area (Oregon, California, and Nevada) population is the only one described as large and loosely connected (Connelly and others, 2004). Washington is the only State with populations of sage-grouse in the Columbia Basin (MZ VI). Only two populations exist in this entire MZ (Moses Coulee and Yakima, Wash.), and both populations are isolated and far removed from the rest of the sage-grouse range (Connelly and others, 2004). These populations are not covered by this report, although similarities and information overlap may exist. The Colorado Plateau (MZ VII) is made up of six populations of sage-grouse in Utah and Colorado. All populations are considered to be small and isolated (Connelly and others, 2004). This MZ also includes populations of *Gunnison* Sage-Grouse. One population (living near Gunnison, Utah) is a *Greater* Sage-Grouse population that was translocated into the range of Gunnison Sage-Grouse. The MZ VII populations are summarized along with populations in MZ II for this report because of the limited area and similar attributes of the few populations living in northwestern Colorado and northeastern Utah.

The highest densities of strutting male sage-grouse occur in MZs I, II, IV, and V (fig. 4; Doherty and others, 2010c). Management Zone III includes lower densities, and MZ VI represents dispersed birds in the Columbia Basin. In the Colorado Plateau (MZ VII), the Gunnison Sage-Grouse persist in the south, whereas small populations of Greater Sage-Grouse persist in the north (fig. 4).

Forty-one discrete populations of sage-grouse (described in reference to MZs above) were defined by Connelly and others (2004; fig. 5). Some of these populations cross MZ boundaries and are thus divided into subpopulations for management purposes. Detailed descriptions of populations and subpopulations and justification for their definitions were provided in the WAFWA Conservation Assessment (Connelly and others, 2004), and a summary of that information is provided here (fig. 5). The most isolated populations occur in Colorado, Utah, Nevada, California, and Washington. Of the seven MZs, the most populations occur in MZs III and IV.

The species' range and total population size have declined dramatically from historical levels (Hornaday, 1916; Crawford, 1982; Drut, 1994; Braun, 1998; Schroeder and others, 1999). Analysis of rangewide decline between 1965 and 2003 revealed an average of 2-percent decline per year with the earlier years (1965–1985) declining at a greater rate, 3.5 percent, than the later years when the rate slowed to 0.37 percent (Connelly and others, 2004). Two additional analyses found similar rates of decline using different statistical techniques and additional years of data (Western Association of Fish and Wildlife Agencies, 2008; Garton and others, 2011). Connelly and others (2004) also estimated that sage-grouse numbers in the 1960s and 1970s were double or triple current numbers, an analysis that was corroborated by Garton and others (2011). Three analyses of sage-grouse population trends within MZs showed long-term population declines in most MZs (Connelly and others, 2004; Western Association of Fish and Wildlife Agencies, 2008; Garton and others, 2011). Only one MZ (VII) has recently demonstrated population trend estimates that were not negative. Estimated trends in populations are summarized (table 2) by MZ for each of the three studies (U.S. Fish and Wildlife Service, 2010b). Declines in male population estimates (table 3) were considerably larger than effect sizes for the total population (table 2). The minimum number of male sage-grouse in 2007 was estimated (Garton and others, 2011b), along with the percent change in number of males per lek and percent change in active leks between 1965 and 2007. The most male sage-grouse occur in MZ II, and the least are in MZ VII. The highest percent change (decline) in number of males per lek and the largest percent change in active leks both occurred in MZ VI.

Genetic Diversity, Population Structure, and Sustainability

The spatial organization of populations across a species' range is an important factor influencing its long-term viability. Species that have multiple interconnected populations are more likely to persist because the risk of extirpation caused by regional events is confined to local populations; connectivity among populations ensures that re-colonization can occur following local extirpation assuming that sufficient suitable habitat remains (Gilpin and Hanski, 1991; Hanski and Thomas, 1994; Hanski, 1998). Thus, movement by individuals within this spatial network is expressed through gene flow, one of the most critical, yet least understood, processes governing species persistence. For several grouse species, patches of unsuitable/poor habitat above a particular size threshold have been

Table 1. Recognized populations and subpopulations of sage-grouse included in this analysis.

Management Zones	Population Subpopulation	Approximate Separation from Adjacent Populations (km)	Brief Description
1	Dakota (Mont./N. Dakota/S. Dakota)	30–40	Isolated population, fragmented
	Fall River S. Dakota/ Eastern Wyoming	10–20	Small population, fragmented
	Alberta/ Southwest Saskatchewan/ Montana	20, narrow corridor	Isolated population
	North Central Montana	20	Large population, isolated by river
	South Central Saskatchewan/ Montana	20–40	Fragmented
	Central Mont.	N.A.	Large population, isolated by river
	Eastern Interior Mont./Northeastern Wyoming	10–20	Large population, loosely connected
2	Eastern Tavaputs Plateau, Utah	50	Small population, isolated
	Eagle/ Southern Routt, Colorado	20–30 and mountains	Small population, isolated
	Garfield, Colorado	40	Small population, isolated
	Jackson Hole, Wyoming	50	Small population, isolated
	Laramie, Wyoming	30 and mountains	Small population, isolated
	Middle Park, Colorado	20–30 and mountains	Isolated
	Northeastern-Interior, Utah	30–50	Isolated, natural fragmentation
	Summit/Morgan, Utah	20–40 and mountains	Small population, isolated
	Dinosaur, Utah/ Colorado	10–20, narrow corridors	Isolated
	North Park Colorado/ Wyoming	10, narrow corridor	Isolated, loosely connected
	South Central Mont./North Central Wyoming	10–40	Large population, loosely connected
	South Central, Wyoming/North Central, Colorado	N.A.	Large population, loosely connected
	Southwestern Wyoming/ Northwestern Colorado/ Northeastern Utah/ Southeastern Idaho	N.A.	Large population, loosely connected
3	Central Nevada	N.A.	Large population, natural fragmentation
	Southeastern Nevada/ Southwestern Utah	N.A.	Large population, natural fragmentation
	Gunnison Range, Utah	200	Small, translocated population, isolated
	No. Mono Lake California / Nevada *	20–40 and mountains	Isolated
	Northwestern Interior Nevada	20–30	Dispersed and isolated sub-populations
	Pine Nut, Nevada	50–60 and valleys	Small population, isolated
	Quinn Canyon Range, Nevada	50–80 and valleys	Small population, isolated
	S Mono Lake, California *	20–50 and mountains	Small population, isolated
	S White River, Utah	40–50	Small population, isolated
	Sanpete/Emery, Utah	50–60	Small population, isolated
	S-Central, Utah	50–70 and mountains	Small population, isolated
	Tooele/Juab, Utah	40	Small population, isolated
	White Mountains, Nevada/ California *	50 and mountains	Small population, isolated

Table 1. Recognized populations and subpopulations of sage-grouse included in this analysis.—Continued

Management Zones	Population Subpopulation	Approximate Separation from Adjacent Populations (km)	Brief Description
4	Baker, Oregon	30	Small population, isolated
	Bannack, Mont.	30–50 and Continental Divide	Small population, isolated
	Belt Mountains, Mont.	70, narrow corridor	Small population, isolated
	E-Central, Idaho	30–50	Isolated
	Red Rock, Mont.	20–40 and mountains	Small population, isolated, natural fragmentation
	Sawtooth, Idaho	70–80	Small population, isolated
	Big Lost, Idaho	10, narrow corridors	Loosely connected
	Lemhi-Birch, Idaho	20 and topography	Isolated
	Little Lost, Idaho	20 and narrow corridors	Loosely connected
	N Side Snake	10–30	Large population, loosely connected
	Upper Snake	20–40 and mountains	Isolated
	Twin Bridges, Montana	60	Small population, isolated
	Weiser, Idaho	20	Small population, isolated
	Wisdom, Montana	4–60	Small population, isolated
5	E-Central Oregon	10–30	Loosely connected
	Lake Area Oregon/ Northeastern California/ Northwestern Nevada	20–50	Large population, loosely connected
	South Central Oregon/North Central Nevada	20–30	Several connected subpopulations
	Northeastern Nevada/South Central Idaho/Northwestern Utah	10–20	Large population, loosely connected
	North Central Nevada/ Southeastern Oregon/ Southwestern Idaho	10–20	Several connected subpopulations
	Central Oregon	30	Isolated and fragmented
	Klamath, Oregon/ California	50	Small population, fragmented
	Warm Springs Valley, Nevada	30–60 and valleys	Small population, isolated, fragmented
6 *	Moses Coulee, Washington *	50 and Columbia R.	Isolated
	Yakima, Washington *	50 and Columbia R.	Isolated
7 (2)	Piceance, Colorado	30–40	Small population, isolated
	White River, Colorado	30–40 and mountains	Small population, isolated

*Recognized populations which are not part of this assessment.

(Adapted from Connelly and others, 2004.)

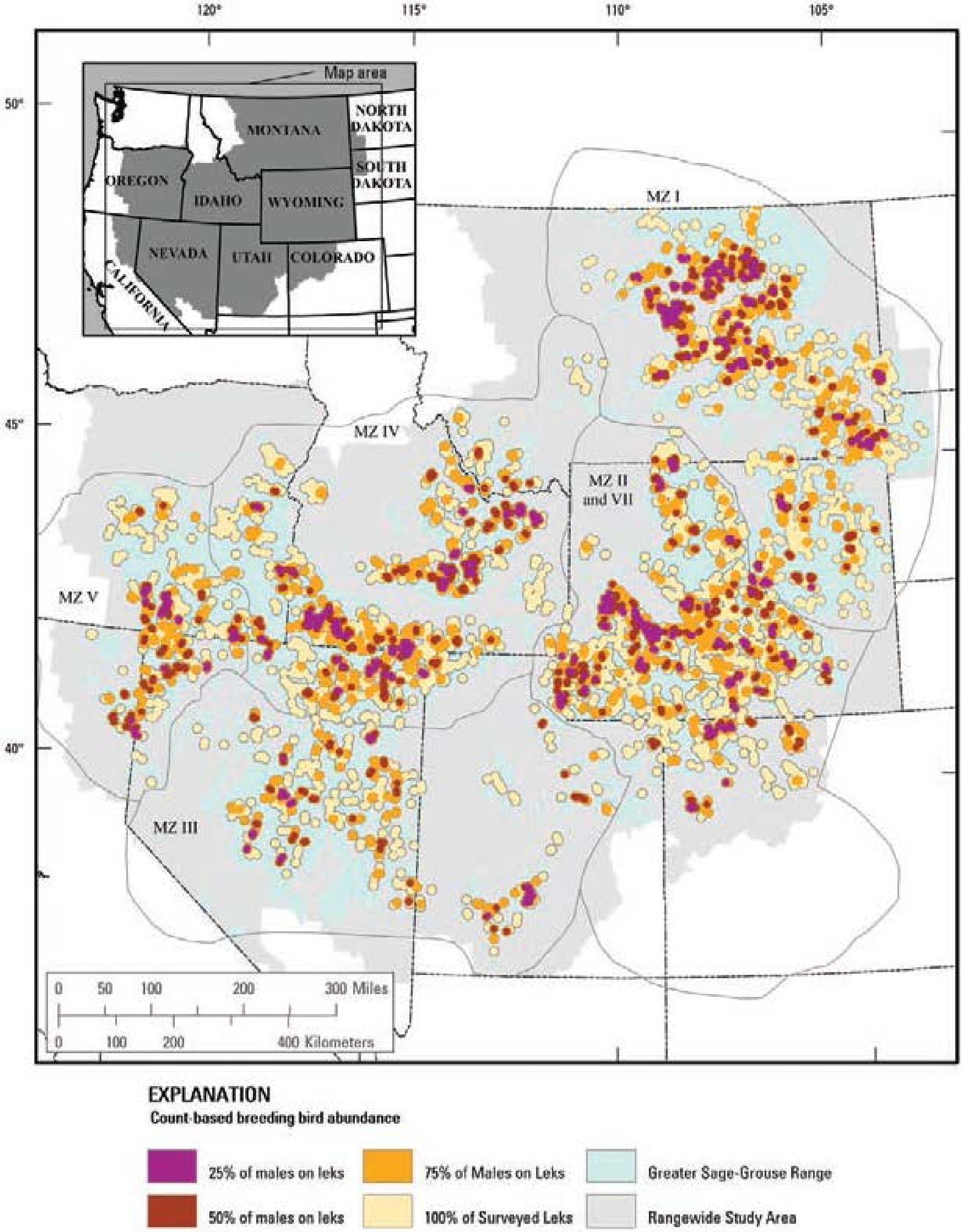

Figure 4. Concentrations of strutting males at leks, an indication of the distribution of individuals, populations, and reproductive effort across Management Zones (MZ).

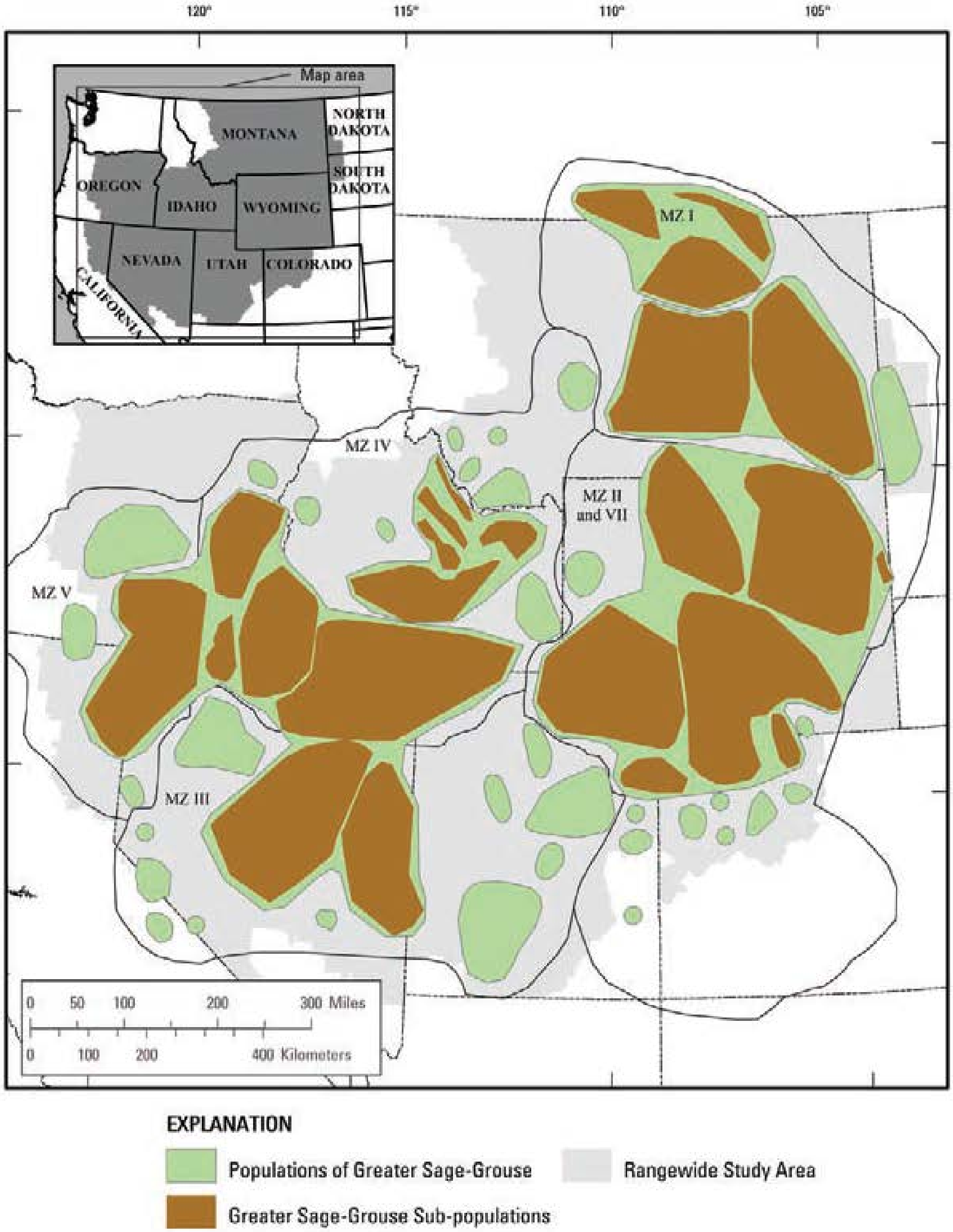

Figure 5. Greater Sage-Grouse populations and subpopulations. MZ, Management Zone.

Table 2. Estimated trends in population size for each sagebrush Management Zone (MZ).

MZ	State and Provinces Included	Population Trend Estimates 1965–2003* (Connelly and others, 2004)	Population Trend Estimates Based on Annual Rates of Change (%) 1965–2007 (WAFWA 2008)	Population Trend Estimates Based on Annual Rates of Change (%) 1965–2007 (Garton and others, 2011)
I	MT, WY, ND, SD, SK, AL	Long-term decline	–2.9	–2.9
II	ID, WY, UT, CO	Long-term decline	–2.7	–3.5
III	UT, NV, CA	Long-term decline	–2.2	–10**
IV	ID, UT, NV, OR	Long-term decline	–3.8	–4**
V	OR, CA, NV	Change statistically undetectable	–3.3	–2**
VI	WA	Long-term decline	–5.1	–6.5
VII	CO, UT	Change statistically undetectable	No detectable trend	+34**

*Average annual rate of change was not reported.

**Due to sample inadequacies for the statistical analyses used, only data from 1995 to 2007 could be used.

(Adapted from USFWS, 2010, table 5.)

Table 3. Male sage-grouse minimum population estimates (2007), percent change in number of males per lek, and percent change in number of active leks 1965–2007 by Management Zone (MZ).

MZ	Minimum Population Estimate in 2007 (number of males)	Percent Change in Number of Males per Lek (1965–2007)	Percent Change of Active Leks (1965–2007)
I	14,814	–17	–22
II	42,429	–30	–7
III	6,851	–24	–16 ***
IV	15,761	–54	–11***
V	6,925	–17**	–21**
VI	315	–76	–57
VII	241	–13	–39*

*1995 to 2007—due to sample sizes, only data from this time period were used.

**1985 to 2007—due to sample sizes, only data from this time period were used.

***1975 to 2007—due to sample sizes, only data from this time period were used.

(Adapted from Garton and others, 2011.)

shown to prevent successful movement of individuals between populations (Piertney and others, 1998; Oyler-McCance and others, 2005a; Fedy and others, 2008).

The rangewide extent of almost all species, including sage-grouse, is orders of magnitude larger than the dispersal distance of any single individual. In addition, heterogeneity in habitat quantity, configuration, and quality creates spatial discontinuities in population densities. Consequently, species distributions do not consist of a single panmictic population but instead can be best described by a meta-population structure having hierarchical levels of connectivity (Weins and others, 1993). At larger ecological scales, less frequent but longer movements by individuals between populations influence rangewide connectivity and are essential for population persistence. The probability that an individual will move from one population to another is influenced by the species' life-history strategies, relative densities among populations, and the cost to movement. At smaller ecological scales, short dispersals characteristic of most individuals result in the majority of breeding occurring within a relatively distinct and confined area characterized by extensive internal connectivity. Importantly, sage-grouse have demonstrated strong site fidelity suggesting resistance of individuals to adjust to changing habitat conditions (Berry and Eng, 1985; Fischer and others, 1993; Schroeder and Robb, 2003; Holloran and Anderson, 2005; Moynahan and others, 2007; Baxter and others, 2008; Doherty and others, 2010a; Holloran and others, 2010). Identification of these demographically independent populations and defining their boundaries is a fundamental component to managing any wildlife species.

In addition to population connectivity, maintaining sufficient levels of genetic diversity is also important for population viability and persistence. Observations of inbreeding depression in captive (Lacy and others, 1996) and field populations (Jimenez and others, 1994; Keller and others, 1994; Keller and Waller, 2002) and studies of heterozygosity-fitness relations (Reed and Frankham, 2003) have led to the realization that loss of genetic variation could affect population viability (Gilpin and Soule, 1986; Lacy, 1997). Furthermore, observations of wildlife populations that have experienced loss of genetic variation due to bottlenecks also support the conclusion that such losses can affect population productivity, particularly in lek-breeding birds (Bouzat and others, 1998) such as sage-grouse. Practices that lead to reduced genetic variation, such as establishing populations with only a few individuals or allowing populations to remain small and fragmented, might have serious consequences for population viability. Concerns about effects of inbreeding on demography relate to time scales that are relevant to management activities (Westemeier and others, 1998; Johnson and Dunn, 2006). On a longer time scale, managers must be concerned about loss of allelic variation that can affect the ability of populations to adapt to new environmental challenges (Allendorf and Leary, 1986; Frankham, 1995), including enhanced susceptibility to parasitic agents or infectious disease such as West Nile virus, which has been shown to be a significant threat for sage-grouse (Naugle and others, 2004).

Most conservation geneticists promote maintaining large effective sizes of well-connected populations to prevent loss of genetic variation and possible associated reductions in population viability. Recommendations concerning population sizes necessary to prevent adverse genetic consequences vary considerably; there is no general agreement on what appropriate minimum numbers are acceptable for long-term management goals (Gilpin and Soule, 1986; Simberloff, 1988; Hedrick and Kalinowski, 2000; Reed and Bryant, 2000). Most published recommendations of minimum population size are in terms of minimum effective size, and these recommendations indicate that the number of breeding-age individuals in most populations should be at least two to four times larger than the minimum effective size. This is particularly relevant for sage-grouse whose effective population size may be much less than census size due to their highly skewed mating system.

Sage-grouse need vast expanses of sagebrush habitat to meet their seasonal habitat needs (Connelly and others, 2004; Connelly and others, 2011d). Fundamental to developing conservation objectives for sage-grouse is to identify and subsequently design strategies to maintain a set of viable and connected populations. Therefore, it is important to know (1) the spatial delineation of breeding populations of sage-grouse, (2) how primary populations are interconnected across regions of lower population densities and less suitable habitat, and (3) the spatial scale and relative importance of landscape features that influence gene flow. Currently, an understanding of how populations are spatially structured for sage-grouse is somewhat limited. The characteristics of gene flow within and among populations and what landscape features represent barriers to sage-grouse dispersal that are significant enough to fragment or isolate populations are largely unknown. Distance, topography, or large blocks of unsuitable habitat all potentially influence dispersal at local and regional scales. Few studies using conventional radio-telemetry techniques or recaptures of marked individuals have documented either dispersal distances or landscape features that influence dispersal patterns. Considerable money and effort has been spent tracking the movement of animals using radio-telemetry and band recoveries for sage-grouse. Although these methods are effective, they are limited in the spatial and temporal scale of the questions they can address.

A recent model of the rangewide spatial structure of sage-grouse based on the mapped distribution of leks delineated numerous small populations interspersed between a few large populations and around the periphery of the range by clustering leks interconnected within an 18 km (11 mi) dispersal distance (fig. 6; Knick and Hanser, 2011). Concern over the degree of isolation of the small populations is warranted. Current sagebrush habitats were relatively intact within the large populations. Nonetheless, additional habitat loss caused by natural or human disturbance could fragment and divide these large populations as well as further isolate small

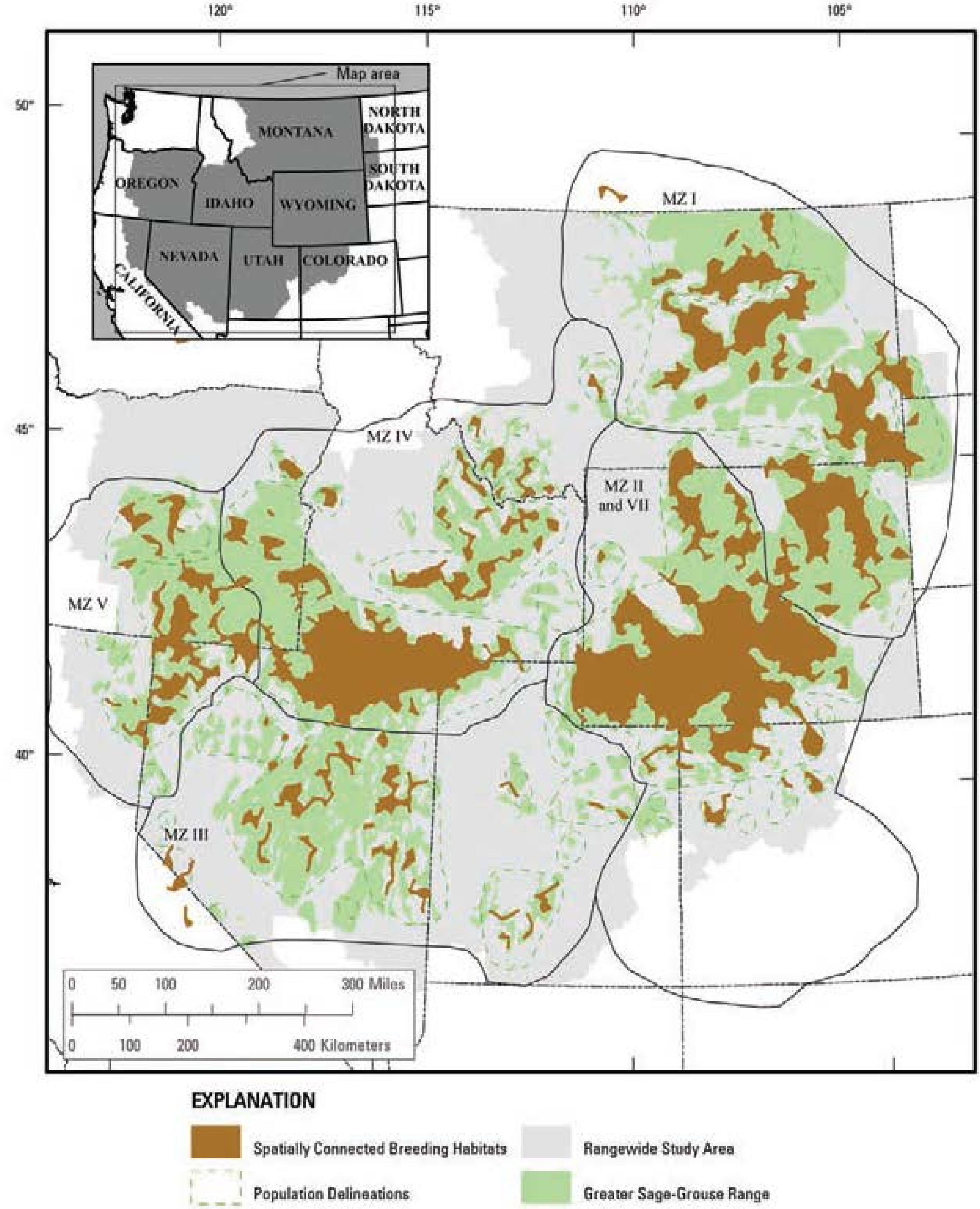

Figure 6. Spatial connectivity within sage-grouse population structure across the current species' range. MZ, Management Zone.

populations whose viability may depend on dispersal from neighboring populations.

A complementary approach to understanding population boundaries and movement among populations uses genetic methods that allow for assessment over broad spatial extents and the measurement of the actual breeding consequences of animal movement. In addition to defining populations and measuring connectivity, genetic approaches also address many other relevant questions including the conservation of genetic diversity, the impacts of inbreeding, and the association between habitats and genetics. Previous genetic work has provided a coarse-scale examination of the distribution of genetic variation across the entire range of sage-grouse using both mitochondrial DNA (mtDNA) sequence data and data from nuclear microsatellites (Oyler-McCance and others, 2005b). In this study, 1,080 samples were collected from 46 populations from all U.S. States with populations of sage-grouse and one Canadian province (Alberta) spanning the entire range of the species (Oyler-McCance and others, 2005b). Overall, Oyler-McCance and others (2005b) found the distribution of genetic variation showed a gradual shift across the range in both mitochondrial and nuclear datasets. This pattern suggests localized gene flow with isolation by distance, for example movements common among neighboring populations yet highly unlikely across distant portions of the range. A genetic-clustering analysis (fig. 7; Oyler-McCance and others, 2005b) revealed that unique genetic clusters were comprised of populations geographically adjacent to one another, and though most genetic clusters consisted of many populations, the smaller, more fragmented populations on the periphery of the range (in Colorado, Utah, Bi-State in Nevada/California, and Washington) comprised their own clusters, suggesting lower amounts of gene flow in these areas (peripheral isolates). These data are consistent with previous research on dispersal (Dunn and Braun, 1985), suggesting that gene flow is likely limited to the movement of individuals between neighboring populations and not likely the result of long-distance movements of individuals (across large portions of the range). Their data suggest linkages among neighboring populations and differences among distant populations. This raises the possibility that local adaptations may exist, and therefore, translocations involving neighboring populations rather than geographically distant populations are more likely to succeed.

In addition to estimating levels of connectivity among populations, genetic analysis can compare levels of genetic diversity and document genetically unique populations. Similar to previous findings, (Benedict and others, 2003), recent analyses by Oyler-McCance and others (2005b) revealed that the least amount of genetic diversity occurred in the two Washington populations (MZ VI), which was likely caused by prior habitat loss, isolation and subsequent population decline. One population sampled in Utah, Strawberry Valley, was also found to have low genetic diversity, likely due to a severe genetic bottleneck caused by unnaturally high predation. The Bi-State population (MZ III) was found to be genetically unique compared to all other populations, and the difference was striking. Most individuals (93 percent) in the Bi-State population contained novel mtDNA haplotypes not found elsewhere across the range. The genetic diversity present in the Bi-State population, however, was comparable to (if not higher than) most other populations, suggesting the differences were not due to a genetic bottleneck or founder event. Nuclear data corroborated these data as the Bi-State population was significantly different from all other populations and was the only population forming its own unique genetic cluster (fig. 7).

Under the National Greater Sage-Grouse Land Use Planning Strategy, BLM and USFS are designing management actions for sage-grouse based on identifying priority areas containing the highest densities of breeding birds and their seasonal and annual habitats. This approach is intended to reduce threats to priority habitat and focus limited conservation resources in regions that have the greatest potential to benefit the largest proportion of sage-grouse (Doherty and others, 2011c). Complementary to the priority areas, general habitat areas will also be identified with objectives related to maintaining connectivity, movement, and genetic diversity (Bureau of Land Management, 2011a). As a trade-off, energy and other development may be proposed within general habitat under less restrictive stipulations. However, meeting the overall goals for sage-grouse in this approach will rely on avoiding the unintended consequence of isolating sage-grouse populations within priority areas. Therefore, it is important to understand how sage-grouse populations are structured, the relation of breeding populations to delineated core areas, and how landscape features influence dispersal among core areas.

The concepts of structural and functional connectivity are critical components for guiding conservation actions emphasizing priority areas coupled with identifying and maintaining corridors to facilitate gene flow through general habitat. Structural connectivity, the spatial arrangement of habitat and environmental variables, is an important first step and is the foundation for delineating priority areas. Recent rangewide assessments (Connelly and others, 2004; Rowland and others, 2006; Knick and Connelly, 2011b) have provided extensive spatial information on habitats, threats, and conservation actions that is necessary for understanding the structural connectivity of habitats (Tischendorf and Fahrig, 2000). These data help delineate the spatial patterns of important ecological components for sage-grouse. Ongoing genetic studies that incorporate landscape data are attempting to better understand functional connectivity, which is based on interpreting the spatial arrangement of habitats from a species' perspective (Wiens, 2002). Functional connectivity is far more challenging to study than structural connectivity, but it provides information on the processes underlying the patterns. State and Federal agencies have the opportunity to influence the future form and function of sagebrush landscapes across broad regions through resource planning, and sage-grouse population and habitat connectivity are an important consideration for this process. Landscape-genetics concepts provide keys to developing conservation strategies by identifying population strongholds, habitat connectivity, and movement corridors that

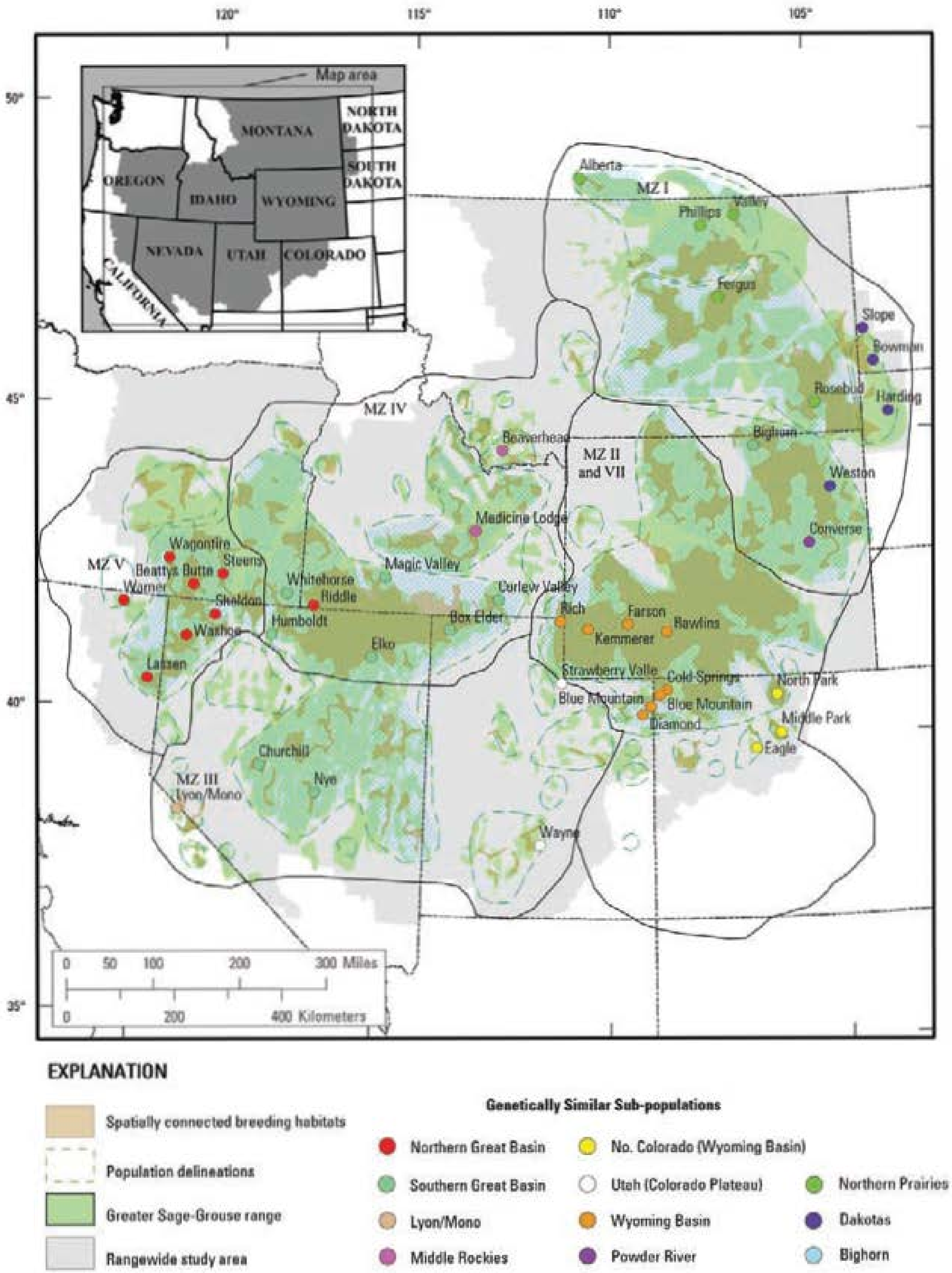

Figure 7. Map of sampling sites for the microsatellite analysis assigned by 'Structure' analysis; genetic similarity is implied for subpopulations with similar color coding. MZ, Management Zone.

facilitate dispersal and gene flow and are, therefore, important to sustain population viability.

Habitat Characteristics and Ecosystem Associations

Sage-grouse is a sagebrush-obligate species that relies on a variety of sagebrush dominated communities to meet various needs throughout their life cycle (Patterson, 1952; Braun and others, 1976; Connelly and others, 2004; Connelly, 2005; Miller and others, 2011). Sage-grouse are closely tied to sagebrush communities and the range of sage-grouse includes at least eleven species, or subspecies (as many as 20 identified in some States), of sagebrush (*Artemisia* spp.) that differ in their associated plant communities, productivity, resilience, and ability to resist disturbance (Miller and Eddleman, 2000; West and Young, 2000; Connelly and others, 2004; Knick and Connelly, 2011a). Sagebrush communities comprise diverse plant communities that include perennial grasses and forb species with composition, structure, and productivity influenced by abiotic conditions such as topography, elevation, precipitation, and soil (Miller and Eddleman, 2000; Connelly and others, 2004). The species of sagebrush most commonly associated with sage-grouse include *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush), *A. t.* ssp. *vaseyana* (mountain big sagebrush), *A.t. tridentata* (basin big sagebrush), *A. arbuscula* (low sagebrush), *A. nova* (black sagebrush), *A. frigida* (fringed sagebrush), and *A. cana* (silver sagebrush; Schroeder and others, 1999; Connelly and others, 2004). The distribution of sage-grouse is highly correlated with the distribution of sagebrush across its distribution in North America (Schroeder and others, 2004).

In the spring, during the breeding season, sage-grouse males seek out lek sites that are open areas of bare soil, short grass steppe, windswept ridges, or exposed knolls in which to gather and perform their ritualized mating displays (Patterson, 1952; Connelly and others, 2004) in order to attract females for breeding. The location of active leks is generally known, and this information has been used to define MZs, planning units, and research designs as discussed throughout this report. The timing of lek attendance varies considerably depending on snow depth, elevation, weather, and geographic region with first attendance ranging from the end of February to early April and ending in late May or early June (Eng, 1963; Schroeder and others, 1999; Aldridge, 2000; Hausleitner, 2003; Connelly and others, 2004). Such lek sites are typically open areas (low-shrub cover) located in the midst of denser shrub stands, which together provide the necessary combination of visibility, protection, food, and thermal regulation (Connelly and others, 1981; Connelly and others, 2000b; Connelly and others, 2011b). Females visit leks for copulation and then can travel more than 20 km (12.5 mi) for nesting afterward (Connelly and others, 2000c), yet distances from the lek to nesting areas are highly variable. Five studies that included 301 nest locations revealed that the distance from lek of capture to nesting areas averaged from 3.4 km to 7.8 km (2.1–4.8 mi; Schroeder and others, 1999). Nesting areas tend to be surrounded by sagebrush with an understory of native grasses and forbs with ample vertical and horizontal structure to support a diversity of insect prey, provide cover, as well as herbaceous forage for pre-laying and nesting hens (Gregg, 1991; Schroeder and others, 1999; Connelly and others, 2000b; Connelly and others, 2004; Connelly and others, 2011b). Vegetation characteristics of successful nesting areas have been described with details not provided here (Connelly and others, 2000c).

Egg laying and incubation typically occur 3–4 weeks after peak lek attendance followed by brood-rearing in late spring and early summer (Schroeder, 1997; Aldridge and Brigham, 2003b; Hausleitner, 2003; Connelly and others, 2004). Broods are typically found in areas near nest sites for the first 2–3 weeks after hatching (Connelly and others, 2004). Such habitat needs to provide adequate cover and areas with sufficient forbs and insects to ensure chick survival in this life stage (Connelly and others, 2004). As the chicks get older, sage-grouse tend to move into more moist areas (streambeds or wet meadows) because as herbaceous vegetation dries out, wetter areas provide more forbs and insects for hens and their chicks (Schroeder and others, 1999; Connelly and others, 2000a). Hens without broods and male sage-grouse use wetter areas that are close to sagebrush cover in late summer (Connelly and others, 2004).

Beginning at the end of summer, and extending into fall and winter, the diet of sage-grouse shifts to one comprised solely of sagebrush (Schroeder and others, 1999). During this time, sage-grouse also depend on sagebrush for cover. Habitat selection at the sagebrush-stand level during winter months is driven by the depth of snow (Patterson, 1952; Hupp, 1989), the availability of sagebrush above the snow (Connelly and others, 2004), and topographic patterns (Beck, 1977; Crawford and others, 2004) that create localized habitats providing cover and forage. Because use and availability of these seasonal habitats are spread across a given landscape, sage-grouse require vast areas of contiguous sagebrush to meet their needs on an annual basis (Patterson, 1952; Connelly and others, 2004; Connelly and others, 2011d; Wisdom and others, 2011).

Sagebrush-vegetation types are strongly determined by environmental limitations and gradients driven primarily by temperature and precipitation patterns (Miller and others, 2011). The sagebrush-steppe occurs in the northern portion of the range of sage-grouse from British Columbia and the Columbian Basin in the northwest; south through the northern Great Basin and Snake River Plain; and east into southwestern Montana, the Wyoming Basin, and northern Colorado Plateau (fig. 8). In this type, sagebrush typically co-dominates with perennial bunchgrasses (Miller and others, 2011). The second major type, Great Basin sagebrush, is found south (and west) below the polar-front gradient where the herbaceous component contributes a smaller portion of the total plant cover (Miller and Eddleman, 2000) due to hydrologic patterns. Thus, in this type, sagebrush is frequently the canopy dominant with little understory (Miller and others, 2011). The Great Basin

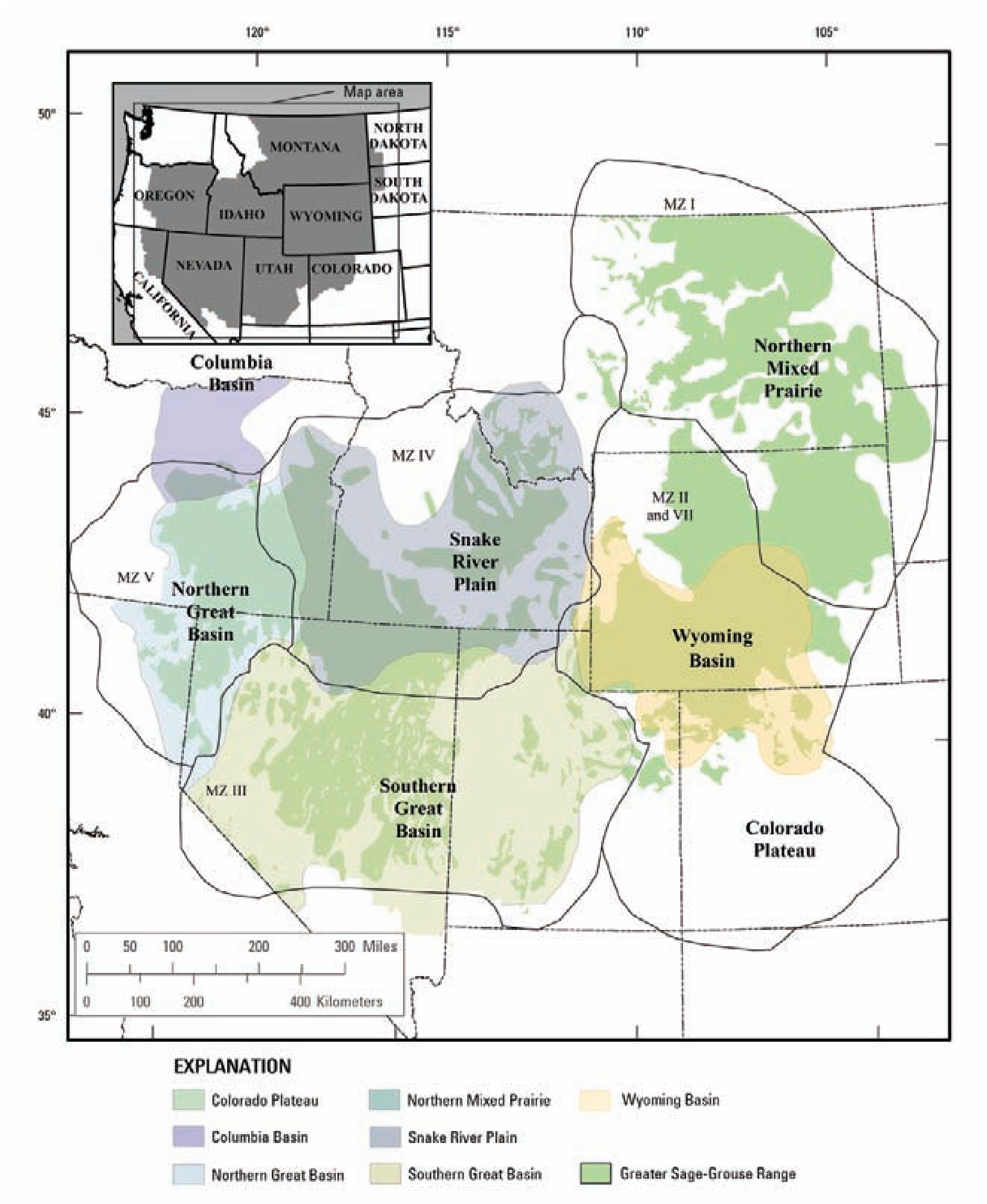

Figure 8. Seven major sagebrush biomes, including the southern Great Basin types (Southern, Northern, and Colorado Plateau), northern sagebrush-steppe (Snake River Plain, Wyoming Basin, and Columbia Basin) and northern mixed prairies. MZ, Management Zone.

sagebrush community type extends from the Colorado Plateau west across Nevada and Utah and into California (Miller and others, 2011). A third major sagebrush-vegetation type, the mixed shrubland, occurs in the Bighorn Basin in north-central Wyoming. A fourth type includes the mixed big sagebrush and silver sagebrush-grasslands (including portions of the Northern Prairies) that are found in eastern Montana and Wyoming (Miller and others, 2011); these support sage-grouse populations primarily within *A. cana* and *A. filifolia* associations.

Multiscale Habitat Selection

Sage-grouse are currently estimated to occupy 165 million acres (668,000 km^2) across the Western United States and Canada (Knick and Connelly, 2011a), and this range encompasses tremendous variability in habitat conditions, anthropogenic activities, and grouse populations. Development of comprehensive monitoring approaches lead to formal recognition that habitat selection assessments are needed to utilize approaches that address multiple spatial scales to represent selection processes of the animals (Connelly and others, 2003b; Connelly and others, 2011d; Stiver and others, 2010). The first-order (1) is the geographic range and defines the sage-grouse population of interest, and within this geographic range (2) characterization of the second-order hinges on large, relatively intact regions of habitat identified using subpopulation distributions (for example, geographic connections among leks or regional population connectivity using genetics) to link habitats to use. The third-order (3) requires refinement from broad habitat delineations by specifying seasonal habitats (for example, nesting habitat), patch selection, and migration habitats. Finally, assessment can be made of fourth-order selection (for example, daily site selection and behavioral observations) by (4) quantifying food and cover attributes and foraging behavior at particular sites. In practice, selection of food items is nested within selection of feeding site because selection of a particular site determines the array of food items available to be selected; importantly, habitat value and use will best be determined using a combination of these characteristics (not one alone). To accurately characterize sage-grouse habitat selection for a given population at the first- and second-orders, or landscape spatial scales, the migratory nature (seasonal movements) of the population must be well understood (see Connelly and others, 2000), and this may include very large areas on an annual basis. It has been suggested that migratory populations may range across hundreds of square miles (Connelly and others, 2003b) with individual movements up to 145 km (90 mi; Smith 2012).

The relative importance of a particular seasonal habitat may be dictated by *quantity* (for example, critical winter habitat may represent a small proportion of the available sagebrush habitats in the area), *quality* (this may be realized when *potential* early brood-rearing habitats are widespread, for example, but suboptimal herbaceous cover reduces value and use of some areas), and *juxtaposition* (as an indication of the necessary proximity of suitable early brood-rearing sites and suitable nesting sites), which together describe relevant local-scale spatial heterogeneity within broadly suitable and available habitats. It is also likely that movement corridors between seasonal sites have particular value for sage-grouse as seasonal habitats (distinct from origination and destination habitats), especially for migratory populations moving long distances between seasons (Connelly and others, 2003). Although the optimal proportions of distinct seasonal habitats required on a landscape for productive sage-grouse populations are unknown, sage-grouse productivity is generally increased if individuals are able to space themselves widely across the available landscape allowing them full advantage of variations in land and habitat to satisfy their cover, forage, solitude, and migratory needs (Holloran and Anderson, 2005).

III. Characterization of Important Threats and Issues

The USFWS 12-month finding, in agreement with recent reviews, research, and analyses provided by the science and management communities (Federal Register 50 CFR Part 17; FWS-R6-ES-2010-0018; Connelly and others, 2004; Knick and Connelly, 2011b), recognized a range of important influences on sage-grouse populations and their successful conservation. These common threats and issues fall into five main categories, which were recognized by USFWS in the published findings—habitat change (Factor A), over-utilization (Factor B), disease and predation (Factor C), chemical poisoning (Factor E), and policy and land use (Factor D)—which may vary in relative importance among MZs but are inclusive and representative of the suite of threats and issues across the species' range. (Factors A-E were originally characterized in the USFWS findings report; we reorganized our treatment of these topics [Factors A, B, C, E, then D] to consolidate conceptually related topics. The organization in this document does not exactly parallel the USFWS Federal Register document, but all topics in the findings report are addressed here.) Each of these topics are addressed in the following pages, with particular attention paid to issues identified by USFWS and others that contribute to direct or indirect impacts on sage-grouse populations. With this broad outlook, it is important to recognize that though over-utilization, disease and predation, and chemical poisoning are recognized as having direct effects (such as mortality) on sage-grouse populations—and the effects of these factors may be the principal cause of population declines in local areas during specific years, for example West Nile virus outbreaks—the impact of these factors on rangewide population sustainability are considered relatively small compared to indirect effects on populations via habitat degradation, policy limitations, and competing land uses. Habitat change (Factor A), which represents a suite of changes in both local conditions (implications for forage, cover and nest quality, for example) as well as regional landscape patterns (implications for habitat availability, connectivity, and isolation, for example), includes the bulk of factors identified in previous research and litigation as affecting sage-grouse populations. Despite research and expertise that address the role of these factors in habitat condition and function of the sagebrush ecosystem, causal connections that precisely relate these factors to population responses are not known in many cases (and likely cannot be consistently and accurately translated as simple causal mechanisms); this is often the case with complicated relations. Thus, many of the following sections outline connections between activities, patterns, and processes recognized as threats to the condition (measured, theoretical, and desired) of the sagebrush ecosystem and the likely, or expected, response of local sage-grouse populations to these influences, as presented in the literature. These discussions and diagnoses may recognize local population details; however, detailed local distinctions are largely beyond the scope of this effort. The broad-scale patterns and associations occurring rangewide and regionally, which are summarized here, will benefit from incorporation with detailed knowledge of local managers, including unpublished reports and similar locally explicit references, when translating these regional patterns into local conservation planning. Therefore, this summary and spatial analysis will inform and enhance local understanding by providing broad-scale data summary and interpretation helping to put local conditions and issues into context and thereby informing the process of developing complete and comprehensive land and resource management planning.

This distinction (local detail versus regional perspective) is consistent with the multiple-scale approach to management and conservation being applied here. This report is focused on providing "global" (first order) and "regional" perspectives (second order); much of the information provided herein is summarized from research on individuals and populations (third and fourth order). Local data, and associated local decisions, are critically important to conservation and management success, but they cannot be accurately represented here (without expanding the scope and effort); local perspectives and decisions need to be informed by local professionals. Information on sage-grouse has been accumulated from many different populations residing in different habitats, and current knowledge is based on combining these disparate sources and extrapolating understanding derived from specific populations and circumstances to establish rangewide consistencies (Crawford and others, 2004). Confounding factors across all populations and analytical units include different causes of mortality in different areas, differences between migratory and resident populations, temporal and spatial differences in habitat conditions, nuances and variability in population estimates, and differences in cycling rates and current position relative to long-term and short-term trends (Fedy and Doherty, 2011).

Recent developments in wildlife conservation have included a shift from project-level to landscape-level perspectives in conservation planning. However, effective management of a species of wildlife under this paradigm typically requires the consideration of several scales. Sage-grouse are a wide-ranging species, and large landscapes need conservation to maintain the species (Connelly and others, 2004; Connelly and others, 2011d). However, habitat degradation—one of the overriding mechanistic factors resulting in population declines—will have to be handled at much smaller scales to restore the condition and function of rangelands.

Factor A: Habitat Change

Sage-grouse populations typically occupy habitats with a diversity of species and subspecies of sagebrush interspersed with a variety of other habitats (riparian meadows, agricultural lands, grasslands, and sagebrush habitats with some conifer or deciduous trees); these habitats are usually intermixed in a sagebrush-dominated landscape and are often used by sage-grouse during certain times of the year (seasonally) or during certain years, for example, a winter with above-normal snowpack (Connelly and others, 2011d). The natural variation in vegetation, the dynamic nature of sagebrush habitats, and the variation in the habitats selected by sage-grouse across a landscape imply that characterizing habitats using a single value or narrow range of values, for example, 15- to 25-percent sagebrush-canopy cover in breeding habitat (Connelly and others, 2000c), is insufficient to describe sage-grouse habitat requirements. The differing seasonal habitat requirements of sage-grouse dictate that multiple vegetation attributes, across the landscape *and* in particular sites, are important, reinforcing emphasis that combinations of shrub overstory and herbaceous understory, which are both important as habitat components during different seasons, are important in combination and across scales (Connelly and others, 2011d). Although animals may have different requirements and selection behaviors in different seasons, seasonal habitats may overlap; for example, winter habitat may also provide brood-rearing habitat in some populations, whereas others may travel great distances between seasonal habitats. Interspersion and juxtaposition of the differing cover types used by sage-grouse on an annual basis within the range of a local population will greatly influence the effectiveness of the landscape to provide quality sage-grouse habitat (Connelly and others, 2011d).

Human alterations, uses, and impacts coupled with natural variability (for example, drought) have changed the extent, condition, and distribution of sagebrush-steppe and the ecosystem services this biome provides (Meinke and others, 2009). Current sage-grouse range is estimated to be 56 percent of historic (pre-European settlement) distribution (Stiver and others, 2006a). Disrupted disturbance regimes, degraded or depressed native species, and dominance by introduced noxious plants have moved many of these systems toward, or beyond, critical thresholds from which restoration is difficult or excessively time-consuming and expensive (Meinke and others, 2009). Three of the fundamental characteristics of the sagebrush biome that have been altered from presettlement conditions include (1) the total area of sagebrush shrubland has been reduced; (2) the composition and structure of the vegetation and soils in sagebrush communities have been changed, including increased abundance and performance of invasive species and decreased abundance and performance of native species; (3) fragmentation created by roads, power lines, fences, energy developments, urbanization, and other anthropogenic features isolate populations by restricting movements or degrading habitat (Connelly and others, 2004). For example, 75 percent of the shrub steppe growing on deep soils has been converted to agricultural croplands (Connelly and others, 2004), and intense historic land use (especially livestock grazing) in the late 19th and early 20th centuries reduced the dominance of native grasses, trampled microbiotic crusts, and encouraged expansion of Eurasian grasses (Anderson and Inouye, 2001; Ponzetti and others, 2007; Root and McCune, 2012). Therefore, long-term conservation of the species as well as sagebrush habitats may, simply stated, hinge on adaptation, reclamation, and recovery of native ecosystems from historic land uses and former practices.

The combination of natural variability (for example, drought) and a legacy of multiple human land uses with various but widespread impacts has induced changes in the extent, condition, and distribution of sagebrush ecosystems and the biological services they provide. Currently, few intact sagebrush ecosystems are in the condition they were in historically (reference conditions), which influences habitat function, and consequentially, the distribution and health of wildlife in the region (Connelly and others, 2004). To better address cumulative effects of multiple (different) land uses, and to begin to account for indirect impacts (besides direct habitat removal, for example), a combination of factors may be combined to estimate a "human footprint" providing an index to assess and compare levels of use and potential impacts (Leu and Hanser, 2011). The human-footprint index considered here indicates the spatial accumulation of effects due to anthropogenic features—including human habitation, highways and roads, railroads, power lines, agricultural lands, campgrounds, rest stops, landfills, oil and gas developments, and human-induced fires—on a landscape expressed on a 1 to 10 scale (Johnson and others, 2011; Leu and Hanser, 2011). The human footprint is most intense at low elevations near valley floors and may have disproportionate effect on sage-grouse populations reliant on these habitats during critical portions of the year (Leu and Hanser, 2011). Across the sage-grouse range, lek count declines were measurable when human-footprint scores exceeded "2" at lek sites and when scores exceeded "3" within either 5 km or 18 km (3.1 or 11.2 mi) of a lek (Johnson and others, 2011). Notably, these values (2 and 3) are toward the low-intensity end of this distribution. In the following pages, six sections summarize information regarding contributions of the human footprint to sage-grouse habitat conditions: (A1) fragmentation and connectivity, (A2) agricultural conversion, (A3) urbanization and human habitation, (A4) general infrastructure, including highways and improved surface roads, railroads, transmission lines and power lines, communication towers, and fences, (A5) energy development and associated infrastructure, and (A6) fire.

A1. Habitat Fragmentation and Connectivity

Sage-grouse populations generally rely on large, interconnected expanses of sagebrush to accommodate local migrations and access to seasonal habitats distributed within their inhabited range (Connelly and others, 2004), and "fragmentation" represents the dissection of large expanses via various mechanisms. Conclusive, consistent data establishing minimum sizes of sagebrush-dominated landscapes necessary to support viable populations of sage-grouse are unavailable (Connelly and others, 2011d). However, some quantitative indications exist, for example sage-grouse populations in Idaho used an annual range of at least 683,000 acres (2,764 km^2; Leonard and others, 2000). Research in Wyoming and Montana suggested that a sagebrush-dominated landscape 77,600 acres (314 km^2) in size may provide the area necessary to maintain breeding habitat around a given lek (Doherty and others, 2008). The size of a landscape needed to support breeding habitats of an interspersed population (for example, an area with *multiple* leks spaced less than 6.2 miles [10km] apart) may exceed 247,000 acres (1,000 km^2; Doherty and others, 2008). Investigations from Idaho and Wyoming suggest that relatively large blocks of sagebrush habitat (>9,900 acres [4,000 ha]) are critical to successful reproduction and overwinter survival (Leonard and others, 2000; Walker and others, 2007a). Mean sagebrush patch size within an 18 km radius (250,000 acres [1,018 km^2]) was more than nine times as large in occupied versus extirpated sage-grouse range; sagebrush patch size in occupied range averaged 10,300 acres (4,173 ha; Wisdom and others, 2011). Based on natural geographic patterns, it has been suggested that sage-grouse may have adapted to a scale of natural fragmentation in sagebrush habitats organized at 2.8–5.6 mi (4.5 to 9 km; Leu and Hanser 2011); research on selection behavior indicated similar, emergent patterns based on spacing between leks (nearest-neighbor distances of 0.36 mi [5.9 km]), mean lek to nest movements (3.2 mi [5.1 km]), and nest to summer range movements generally limited to less than 6.2 mi (10 km; Fedy and others, 2012), supporting this contention.

The scale of the landscape used by sage-grouse changes throughout seasons and may differ between populations based on available habitats. Strong site fidelity of sage-grouse for established nesting habitat (Fischer and others, 1993; Holloran and others, 2005; Thompson, 2012) and suggested for other seasonal habitats (Berry and Eng, 1985; Thompson, 2012) indicates that the "landscape" targeted by an individual female during different life-history stages may be relatively small. The overall landscape requirements for an individual would be the conglomeration of these seasonal habitats combined with the necessary migration corridors (the length of these corridors will be different between and within populations depending on the local landscape as much as on the birds). Thus, the landscape required by an individual is a combination of the seasonal habitat requirements on a relatively small scale, the spatial distribution of those seasonal habitats, and the habitats required to move between those seasonal ranges.

Distances between consecutive-year nests of 0.46 mi (740 m) on average suggest a female will nest (repeatedly) within a 425-acre (172-ha) area during its lifetime (Fischer and others, 1993; Holloran and others, 2005). Additionally, a high degree of fidelity of female offspring to their natal home ranges has been observed (for example, yearling females nesting close to their natal nest) suggesting that family groups of females may inhabit relatively distinct areas (Thompson, 2012). Based on cumulative mean daily movements of sage-grouse broods between hatch and 2-weeks post-hatch (Gregg, U.S. Fish and Wildlife Service, unpub. data, May 2000 – July 2003; received July 2010), early brood-rearing tends to occur within 2.9 mi (4.6 km) of the nest. Sage-grouse generally move ≤6.2 mi (10 km) from nests to summer range—but may travel as far as 50 mi (82 km; Fedy 2012)—and remain in relatively distinct locations upon reaching summer range (Connelly and others, 2011d). In contrast, a majority of sage-grouse move >6.2 mi (10 km) from summer to winter locations with movements of up to 90 mi (145 km) documented (Smith, 2013). Fidelity to a specific region does not appear to be as strong for sage-grouse during winter, and populations have been documented traveling up to 31 mi (50 km) in search of exposed sagebrush after severe storm events in Wyoming (Smith, 2013). Movements from spring to summer range and from summer to winter range generally occur along sagebrush-dominated habitats (Jensen, 2006; Connelly and others, 2011d; Smith, 2013); however, sage-grouse can traverse or circumvent unsuitable habitats between seasonal ranges (Bush, 2009).

In addition to the size of selected habitat patches, lek persistence is strongly related to lek connectivity, which is a measure of the relation between each lek with the maintenance of a regional population network with active dispersal and genetic mixing among subpopulations (Knick and Hanser, 2011). Centrally located, large lek sites have greater importance and metapopulation implications, whereas abandoned leks have lower connectivity importance (Knick and Hanser, 2011). Dispersal distances reported in the literature were compiled and combined to establish the connectivity scale; reported dispersal distances range from 4.6 to 6.6 mi (7.4-10.6 km) for males, 5.5 to 8.1 mi (8.8-13.1 km) for females, and distances of 17 mi (27.6 km) are within the range of variation (Knick and Hanser, 2011). Gene flow in sage-grouse populations is likely limited to the movement of individuals between neighboring populations and not likely the result of long-distance movements of individuals across large portions of the species' range (Oyler-McCance and others, 2005b). Thus, regional connectivity among leks represents a fundamental source of genetic re-combination and metapopulation structure that supports the long-term viability of the species.

Fragmentation in general results in a landscape that consists of remnant areas of native habitats surrounded by a matrix of non-native and typically unsuitable habitats, for example developed or cultivated lands. Fragmentation generally begins to have significant effects on wildlife when suitable habitat becomes less than 30 to 50 percent of the landscape; at lower levels of suitable habitat, the distances between remnant patches of native habitat increase exponentially, and spatial arrangement becomes the critical factor determining success of dispersers finding and using suitable areas (Connelly and others, 2004). Research on fragmented landscapes has focused primarily on the biogeographic consequences of the creation of habitat "islands," which provides little practical value to managers (Saunders and others, 1991). According to Saunders and others (1991), management of fragmented ecosystems has two basic components: (1) management of the internal dynamics of remnant habitats, or managing the natural system; and (2) management of the external influences of non-native areas on these remnant patches. Therefore, management of fragmented landscapes requires integration across land ownership with an approach that incorporates several remnant areas managed as an inclusive system to provide the habitats and resources needed by the sage-grouse population inhabiting the area.

A2. Conversion to Agriculture

One of the fundamental characteristics of western landscapes, which have been altered from pre-settlement conditions, includes a reduction in the total land area dominated by sagebrush (Connelly and others, 2004). Development of vegetation and soil using clearing, tillage, and irrigation (among other practices including seeding, application of fertilizers, pesticides, and herbicides) results in long-term conversion of native sage-grouse habitats to sustained human uses (obviously agriculture, but also subdivisions and exurban developments in portions of all MZs). Cultivated agriculture, primarily cropland, covers more than 56.8 million acres (230,000 km^2; 11 percent) of the total land area within the estimated, historic distribution of sage-grouse, including a 31 mi (50km) buffer (Knick and Connelly, 2011a). Agriculture is defined as predominantly cropland, or lands that have been converted for the production of foods and goods (Knick and Connelly, 2011a). The primary agricultural regions in the sagebrush biome include central Washington and northern Oregon, the Snake River Plains of southern Idaho, northern Utah, northern Montana, southern Alberta, southern Saskatchewan, and western North Dakota (Connelly and others, 2004). Thus, agricultural lands are widespread across the range of sage-grouse (table 4, fig. 9). Approximately 4.4 million acres 17,800 km^2; 3.04 percent) of designated sage-grouse habitat has been converted to crops throughout the range of the species, with approximately 261,400 acres (1,050 km^2; 2.25 percent) of priority habitats and 3.1 million acres (12,500 km^2; 8.90 percent) of general habitats converted in MZ I, the MZ most influenced by agriculture. Indirect effects to sage-grouse of crop lands (estimated as effects on sage-grouse populations due to habitat alterations rather than direct mortality) were assessed using the spatial foraging scale of sage-grouse avian predators, which may be attracted to agricultural lands (6.9 km [4.3 mi]; Boarman and Heinrich, 1999; Leu and others, 2008) to summarize the influence area. Based on this estimate, agricultural lands influence a majority (approximately 84.2

Table 4. Summary of the direct and indirect influences of agricultural lands[*] (crops, tillage, and similar, not open range) across Management Zones (MZs) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2]
MZ I–GP	**11,636,400**	**261,400**	**11,558,300**	**2.25**	**99.33**	**34,663,000**	**3,084,100**	**34,619,100**	**8.90**	**99.87**
BLM	2,994,300	6,600	2,944,300	0.22	25	4,524,900	17,700	4,503,800	0.39	13
Forest Service	292,400	600	292,400	0.21	3	515,300	1,000	515,300	0.19	1
Tribal and Other Federal	219,700	1,300	219,700	0.59	2	2,427,700	534,900	2,427,800	22.03	7
Private	7,132,500	247,400	7,113,800	3.47	62	24,682,800	2,436,900	24,664,400	9.87	71
State	995,600	5,400	986,300	0.54	9	2,498,400	93,300	2,494,100	3.73	7
Other	1,900	0	1,900	0.00	0	13,900	300	13,900	2.16	0
MZ II and VII–WB & CP	**17,476,000**	**113,000**	**14,711,100**	**0.65**	**84.18**	**19,200,200**	**402,300**	**15,046,400**	**2.10**	**78.37**
BLM	9,021,200	2,100	7,091,200	0.02	48	9,012,500	3,200	6,324,600	0.04	42
Forest Service	162,000	0	124,100	0.00	1	452,500	300	407,400	0.07	3
Tribal and Other Federal	784,000	1,400	701,900	0.18	5	1,354,600	5,200	1,252,100	0.38	8
Private	6,233,900	106,100	5,627,900	1.70	38	7,394,800	385,900	6,194,900	5.22	41
State	1,244,800	3,300	1,135,900	0.27	8	979,800	7,700	861,400	0.79	6
Other	30,100	100	30,100	0.33	0	6,000	0	6,000	0.00	0
MZ III–SGB	**10,028,500**	**80,000**	**8,086,800**	**0.80**	**80.64**	**3,970,100**	**4,600**	**2,803,800**	**0.12**	**70.62**
BLM	6,309,400	3,800	4,679,000	0.06	58	3,199,800	1,000	2,191,500	0.03	78
Forest Service	1,236,200	400	1,065,000	0.03	13	356,200	0	243,300	0.00	9
Tribal and Other Federal	260,800	2,100	246,000	0.81	3	29,100	0	13,000	0.00	0
Private	1,836,200	72,900	1,720,100	3.97	21	384,800	3,500	355,700	0.91	13
State	385,900	800	376,500	0.21	5	200	0	200	0.00	0
MZ IV–SRP	**21,930,600**	**72,300**	**18,309,700**	**0.33**	**83.49**	**10,958,500**	**257,400**	**9,762,400**	**2.35**	**89.09**
BLM	13,710,700	14,800	10,960,600	0.11	60	4,928,200	14,500	4,227,900	0.29	43
Forest Service	1,613,800	900	1,452,800	0.06	8	1,113,500	1,800	1,009,300	0.16	10
Tribal and Other Federal	633,600	500	573,300	0.08	3	522,500	1,800	478,200	0.34	5
Private	4,890,200	55,200	4,404,300	1.13	24	3,516,742	233,600	3,272,000	6.64	34
State	1,019,373	800	855,800	0.08	5	846,200	4,400	743,600	0.52	8
Other	62,900	200	62,800	0.32	0	31,400	1,300	31,400	4.14	0

Table 4. Summary of the direct and indirect influences of agricultural lands* (crops, tillage, and similar, not open range) across Management Zones (MZs) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2]
MZ V–NGB	**7,097,200**	**6,300**	**4,711,300**	**0.09**	**66.38**	**5,808,000**	**58,300**	**4,948,800**	**1.00**	**85.21**
BLM	5,117,500	300	3,333,900	0.01	71	4,196,700	700	3,435,400	0.02	69
Forest Service	62,200	0	60,800	0.00	1	114,900	0	104,700	0.00	2
Tribal and Other Federal	717,100	0	223,400	0.00	5	101,800	300	76,900	0.29	2
Private	798,000	3,000	696,300	0.38	15	1,199,000	55,700	1,155,900	4.65	23
State	64,900	0	60,200	0.00	1	115,800	400	96,100	0.35	2
Other	337,500	2,900	336,700	0.86	7	79,800	1,200	79,800	1.50	2

*Data Source: National Agriculture Statistics Service Cropland Data Layer 2012.

[1]Direct footprint is the co-location of agricultural lands within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from foraging distances of predators (Boarman and Heinrich, 1999; Leu and others, 2008).

[2]For each MZ, these were calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone; these were calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences

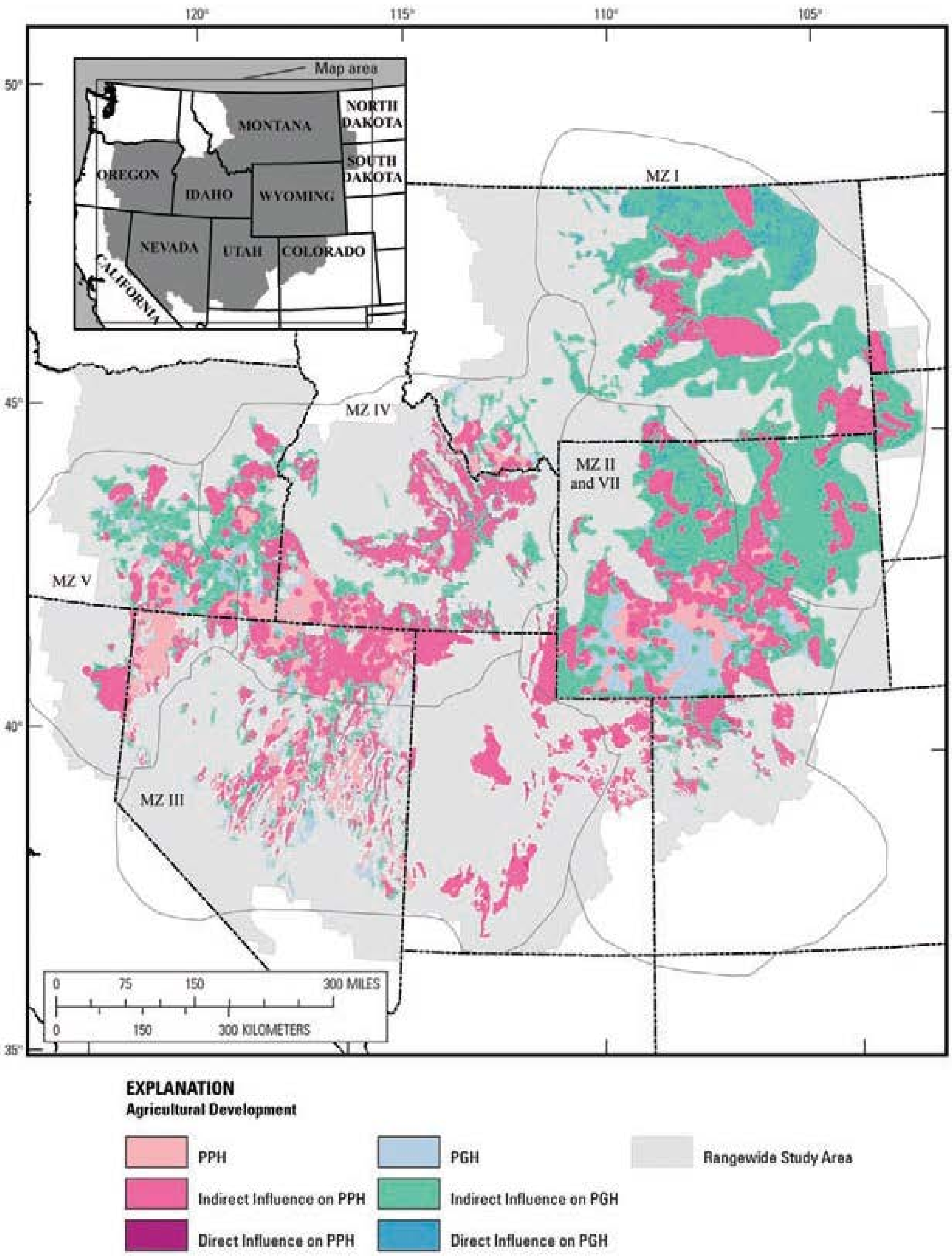

Figure 9. Overlap of agricultural land development, potential indirect effects of agriculture, and preliminary priority habitats (PPH) and preliminary general habitats (PGH) for sage-grouse. MZ, Management Zone.

percent) of priority habitats throughout the species' range. Although little BLM land has been directly converted, this approach suggests that BLM administers approximately 50 percent of the priority habitats influenced by agriculture. Areas converted to croplands are generally those with deeper, loamy soils that are able to be irrigated while sagebrush remains in arid areas where soils and topography are limiting to crops; agriculture has replaced 75 percent of the shrub steppe in deep soils but only 15 percent in shallow soils (Connelly and others, 2004). Summary analyses indicate that though agricultural conversion is widespread across and within MZs, current overlap with PPH and PGH designations vary among MZs, which will help differentiate priorities among management entities within each MZ (table 4).

Conversion of sagebrush to agriculture can influence the ability of sagebrush-dominated landscapes to support sage-grouse through habitat loss and fragmentation (Connelly and others, 2004). Isolation of shrub steppe habitats increased, mean patch size decreased, and number of patches increased with habitat conversion to agriculture in Washington (Connelly and others, 2004). Agricultural development can also influence sage-grouse by providing access to sagebrush habitats for predators such as domestic cats, red fox, and corvids (Connelly and others, 2004).

In a comparison of currently occupied versus unoccupied sage-grouse range (see Schroeder and others, 2004), estimates indicated that sage-grouse were extirpated from areas of their range when the proportion of a 735,000 acre (2,975 km^2) area in cropland exceeded 25 percent (Aldridge and others, 2008). A similar analysis of occupied versus unoccupied range reported areas where sagebrush cover was <27 percent (within a 251,500 acre [1,018 km^2] search area) had a high probability of sage-grouse extirpation. Areas with >50 percent sagebrush cover had high probabilities of sage-grouse persistence, and extirpated range contained approximately three times more area in agriculture compared to occupied range (Wisdom and others, 2011). In Idaho between 1975 and 1992, declines in the mean number of males per lek were strongly correlated to increases in the amount of land converted to agriculture, which increased 74 percent in the region during this period. The proportion of sagebrush habitat (positive effect) and the proportion of tillage agriculture (negative effect) within 4 mi (6.4 km) best explained lek persistence in northeastern Wyoming (Walker and others, 2007a). The percentage of cultivated land within 2.5 mi (4 km) of active leks in North Dakota was lower than that around inactive leks, and the proportion of cultivated land (area of cultivated/area of noncultivated) was greater within a region of the State historically occupied, but currently not occupied, compared to a region where sage-grouse still occurred (Smith and others, 2005).

A comparison of treatments in Wyoming, Montana, and Colorado found that eliminating ≥16 percent of the sagebrush-dominated area in a landscape closely associated with a group of leks either through plowing or herbicide spraying was correlated with a 50 to 100 percent reduction in the number of males occupying the leks (Swenson and others, 1987). A similar study suggested greater sensitivity with observed reduction in rangewide sage-grouse lek trends when agricultural land use exceeded 2.5 percent of the area within a 3.1 mi (5 km radius (or 1.5 percent of the area within an 11.2 mi [18 km] radius); trends in lek counts stabilized as the percent of agricultural land increased beyond these proportions, but few leks occurred in areas where the proportion of agricultural land exceeded 50 percent (Johnson and others, 2011). Conversion of 30 percent of the sagebrush-dominated winter habitats within a focused 50,000 acres (202 km^2) area in Montana by plowing and conversion to cropland resulted in a 73 percent decline in the number of breeding-male sage-grouse on leks in the area relative to controls (Swenson and others, 1987). In southern Canada, nesting sage-grouse avoided areas with a high proportion of anthropogenic-edge habitats (borders with a non-natural edge, such as cropland), and broods avoided areas close to cultivated cropland (Aldridge and Boyce, 2007).

The sage-grouse habitat management guidelines (Connelly and others, 2000c) recommend that a minimum of 80 percent of nesting, early brood-rearing, and winter habitats are dominated by a sagebrush overstory; for example, if 20 percent of the sagebrush habitats used by a population of sage-grouse are eliminated through a prescribed fire, these areas need to regrow and provide sagebrush cover useful for sage-grouse prior to additional treatments. The research presented here suggests that this guideline may be most appropriate for short-term habitat treatments (for example, vegetation and fuel treatments). Available research suggests (1) sage-grouse populations may become extirpated when the proportion of a landscape permanently converted from sagebrush to agriculture exceeds 25 to 27 percent, (2) substantial declines in lek counts may occur when this proportion exceeds 16 percent, and (3) lek-count declines may occur when the proportion is as low as 1.5 to 2.5 percent of the landscape.

A3. Urbanization

Low densities of indigenous peoples in western North America (estimated range from one person per 1,500 acres [6 km^2] to as low as one person per every 22,000 acres [90 km^2] in the Great Basin) probably limited their impact on the biophysical landscape, although their activities for hunting, gathering, and burning may have been significant locally (Connelly and others, 2004). Ultimately, settlement by Europeans in sagebrush habitats had a much greater effect on transforming or converting habitats and altering disturbance regimes and animal communities than behaviors exerted by the low densities of indigenous people (Connelly and others, 2004). Human populations have grown and expanded during the past century, primarily in the western portion of the sagebrush biome. Human populations in sagebrush habitats increased between 166 and 666 percent between 1920 and 2000 and between 19 and 31 percent between 1990 and 2000; the amount of uninhabited area (0 residents/km^2) within the Great Basin decreased from 22.2 million acres (90,000 km^2) in 1990 to <3 million acres (12,000 km^2) in 2004 (Knick and

Connelly, 2011a). Although urbanized areas occur throughout the range of sage-grouse, the direct footprint is relatively small with approximately 792,700 acres (3,200 km^2; 0.56 percent) of sage-grouse habitat directly converted to urbanized areas (table 5, fig. 10). Preliminary priority habitats in Utah in particular, and to a lesser degree priority habitat in MZs II and VII, have a higher urbanized footprint than the remainder of the species' range. Indirect impacts of urban areas—estimated as the spatial foraging scale of avian predators that may be attracted to urban areas (4.3 mi [6.9 km]; Boarman and Heinrich, 1999; Leu and others, 2008)—influence a relatively small percentage (approximately 5.7 percent) of priority habitats throughout the species' range suggesting localized potential impacts (versus widespread potential impacts such as with agriculture). BLM lands account for approximately 38 percent of the priority habitats influenced by urban areas, according to our estimates. Rural areas have also been developed throughout the sagebrush region, particularly around urban centers and major highways (Knick and Connelly, 2011a). Although many urban developments in rural areas continue to provide some sagebrush habitat in contrast to total urban conversion, habitat fragmentation and disturbance from human dwellings and activities probably render much of the area inhospitable to sage-grouse (Connelly and others, 2004). Comparison of currently occupied to historically occupied (presumed extirpated) sage-grouse range determined that mean human density (circa 1950 and 2000) was up to 26 times lower in currently occupied range (Aldridge and others, 2008; Wisdom and others, 2011).

There is little information directly assessing the response of sage-grouse to urbanization. Research in Canada revealed that brood-rearing females avoided habitats associated with a high density of urban developments (Aldridge and Boyce, 2007). Urban areas by themselves remove habitat and present inhospitable environments for sage-grouse, but the physical boundaries of cities are small relative to the total sagebrush area. The roads, railways, power lines and communications corridors connecting urban centers may exert a greater influence on sagebrush habitats than that exerted by the actual city (Connelly and others, 2004). Additionally, recreation, including hiking, hunting and fishing, and OHV use in areas surrounding urban centers can negatively influence sage-grouse through habitat loss and fragmentation, facilitation of exotic plant spread, animal displacement or avoidance, establishment of population barriers, or increased human-wildlife encounters that increase wildlife mortality (Connelly and others, 2004). Recreation on lands managed by the BLM remains a significant land use with potential impacts to range conditions and sage-grouse populations (Connelly and others, 2004; also see Section III. A12. Other Land Uses). The cumulative nature of changes to the sagebrush biome as a result of human encroachment needs to be considered when managing sage-grouse. Potential synergistic effects of the components of urbanization—including the stresses in habitats surrounding urban centers—may influence sage-grouse habitat use and demography making growth and mitigation of urban areas and effects an important consideration in many MZs. For example, the development of an energy field (discussed at length below) involves more than the infrastructure required to extract the resource. Urban centers near the developing field will expand with the increased human population in the area, communication towers and power lines will be erected, traffic on highways will increase, recreational use of areas surrounding urban centers will increase, and all these factors individually and in combination may influence sage-grouse populations (Johnson and others, 2011).

A4. Infrastructure

Interstates and major highways are ubiquitous throughout the range of sage-grouse directly influencing 1,338,200 acres (5,400 km^2; 2 percent) of sage-grouse PPH habitat and more than 3 million acres (12,100 km^2) of PPH and PGH combined, with indirect influences (impacts beyond habitat loss and immediate threats of mortality such as via collision) estimated on more than 139 million acres (565,800 km^2) across the range of the species (table 6, fig. 11). Secondary paved roads exist in most sagebrush regions in densities >1.25 mi/100acres (≈5 km/km^2), less than 5 percent of the sage-grouse range is more than 1.5 mi (2.5 km) from a paved road, and almost no area of sagebrush is more than 4.3 mi (6.9 km) from a paved road (Knick and Connelly, 2011a). Indirect influences such as aversions to noise and activities were assessed using 4.6 mi (7.5 km) buffers for interstates and 1.9 mi (3 km) buffers for highways, primary, and secondary routes. Based on indirect effects estimates, interstates and major highways potentially affect the habitat quality of more than 95 percent of priority habitats throughout the range of the species. A large proportion of these roads exist as rights-of-way on public lands, including 55 percent of BLM-managed PPH and 5 percent of USFS-managed PPH (52 percent and 5 percent of PGH, respectively; table 6). In contrast to roads, major railroads are not as widespread throughout the range of sage-grouse and directly influence (including abandoned rail-lines) only 32,500 acres (132 km^2; 0.02 percent) of sage-grouse habitat (PPH and PGH) across the range of the species (table 7, fig. 12). Railroads are slightly more widespread in MZ I and in Wyoming portions of MZs II and VII; additionally, railroads may have a relatively important influence in some priority habitats in central Utah. Indirect effects of non-abandoned railroads (similarly to roads, indirect effects are considered impacts besides immediate habitat loss or mortality due to collision) were assessed using estimated contributions to spread of exotic plant species (1.9 mi [3 km]), which potentially influence approximately 4 percent of priority sage-grouse habitats across the range.

Transmission lines and local distribution lines (collectively power lines) are widespread throughout the range of sage-grouse and are especially prevalent in MZ II and in priority habitats in portions of MZs III and IV (table 8, fig. 13*A*). Major power lines directly influence approximately 3,896,400 acres (276,000 km^2; 2.7 percent) of sage-grouse habitats throughout the range of the species, including approximately

Table 5. Summary of the direct and indirect influences of urban areas[*] across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	**SG Habitat (acres)**	**Direct Footprint[1] (acres)**	**6.9 km Indirect Influence[1] (acres)**	**Direct Footprint[1] (%)**	**Relative Influence[2] (%)**	**SG Habitat (acres)**	**Direct Footprint[1] (acres)**	**6.9 km Indirect Influence[1] (acres)**	**Direct Footprint[1] (%)**	**Relative Influence[2] (%)**
MZ I–GP	**11,636,400**	**5,000**	**436,600**	**0.04**	**3.75**	**34,663,000**	**130,100**	**2,733,300**	**0.38**	**7.89**
BLM	2,994,300	100	34,600	0.00	8	4,524,900	9,300	190,300	0.21	7
Forest Service	292,400	100	9,600	0.03	2	515,300	0	32,400	0.00	1
Tribal and Other Federal	219,700	0	400	0.00	0	2,427,700	200	100,700	0.01	4
Private	7,132,500	4,100	331,800	0.06	76	24,682,800	113,200	2,188,300	0.46	80
State	995,600	800	59,800	0.08	14	2,498,400	7,300	219,000	0.29	8
Other	1,900	0	300	0.00	0	13,900	0	2,600	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**155,700**	**1,875,000**	**0.89**	**10.73**	**19,200,200**	**353,400**	**3,841,800**	**1.84**	**20.01**
BLM	9,021,200	37,400	820,900	0.41	44	9,012,500	106,200	1,431,100	1.18	37
Forest Service	162,000	0	3,500	0.00	0	452,500	24,600	80,500	5.44	2
Tribal and Other Federal	784,000	32,400	86,000	4.13	5	1,354,600	2,500	145,000	0.18	4
Private	6,233,900	79,100	833,600	1.27	44	7,394,800	209,300	2,008,500	2.83	52
State	1,244,800	6,800	126,300	0.55	7	979,800	10,900	175,800	1.11	5
Other	30,100	0	4,700	0.00	0	6,000	0	800	0.00	0
MZ III–SGB	**10,028,500**	**57,200**	**909,800**	**0.57**	**9.07**	**3,970,100**	**14,500**	**144,900**	**0.37**	**3.65**
BLM	6,309,400	4,100	226,500	0.06	25	3,199,800	2,200	81,000	0.07	56
Forest Service	1,236,200	0	50,400	0.00	6	356,200	0	2,400	0.00	2
Tribal and Other Federal	260,800	100	50,400	0.04	6	29,100	0	3,700	0.00	3
Private	1,836,200	51,500	527,500	2.80	58	384,800	12,300	57,700	3.20	40
State	385,900	1,500	54,900	0.39	6	200	0	100	0.00	0
MZ IV–SRP	**21,930,600**	**5,200**	**635,900**	**0.02**	**2.90**	**10,958,500**	**66,700**	**937,800**	**0.61**	**8.56**
BLM	13,710,700	1,100	386,600	0.01	61	4,928,200	19,700	277,700	0.40	30
Forest Service	1,613,800	0	48,000	0.00	8	1,113,500	700	39,200	0.06	4
Tribal and Other Federal	633,600	4,100	20,700	0.65	3	522,500	100	28,200	0.02	3
Private	4,890,200	0	153,400	0.00	24	3,516,742	43,400	535,500	1.23	57
State	1,019,373	0	26,900	0.00	4	846,200	2,800	56,800	0.33	6
Other	62,900	0	400	0.00	0	31,400	0	300	0.00	0

Table 5. Summary of the direct and indirect influences of urban areas* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**300**	**17,000**	**0.00**	**0.24**	**5,808,000**	**4,600**	**92,200**	**0.08**	**1.59**
BLM	5,117,500	0	3,900	0.00	23	4,196,700	0	19,700	0.00	21
Forest Service	62,200	0	0	0.00	0	114,900	0	1,800	0.00	2
Tribal and Other Federal	717,100	0	0	0.00	0	101,800	100	400	0.10	0
Private	798,000	300	13,000	0.04	76	1,199,000	4,500	65,300	0.38	71
State	64,900	0	0	0.00	0	115,800	0	0	0.00	0
Other	337,500	0	0	0.00	0	79,800	0	5,000	0.00	5

*Data Source: Tele Atlas ESRI Street Map Premium for ArcGIS v 9.0, 2008

[1]Direct footprint is the co-location of urban areas within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from foraging distances of predators (Boarman and Heinrich, 1999; Leu and others, 2008).

[2]For each MZ these were calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, these were calculated as the percent of the total indirect impact in the management zone represented by that management entity, that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

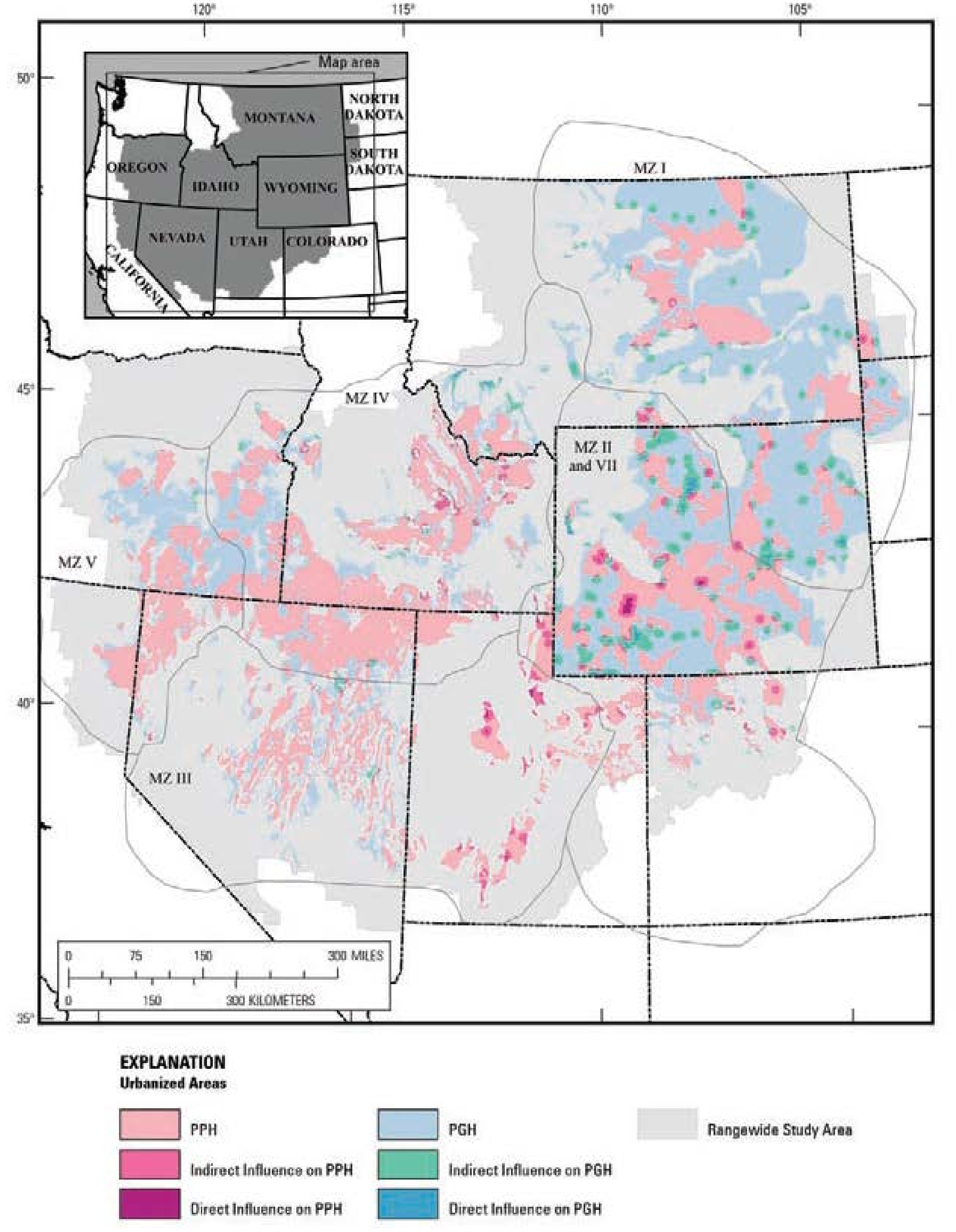

Figure 10. Overlap of urbanized areas, potential indirect influences of urbanization, and sage-grouse preliminary priority and general habitats (PPH and PGH, respectively).

Table 6. Summary of the direct and indirect influences of roads* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**255,300**	**11,602,600**	**2.19**	**100**	**34,663,000**	**887,300**	**34,604,700**	**2.56**	**99.83**
BLM	2,994,300	48,200	2,971,300	1.61	26	4,524,900	79,600	4,511,000	1.76	13
Forest Service	292,400	7,200	292,400	2.46	3	515,300	12,300	515,100	2.39	1
Tribal and Other Federal	219,700	3,300	218,100	1.50	2	2,427,700	61,500	2,418,200	2.53	7
Private	7,132,500	176,200	7,127,900	2.47	61	24,682,800	675,000	24,653,700	2.73	71
State	995,600	20,300	991,200	2.04	9	2,498,400	58,600	2,492,700	2.35	7
Other	1,900	0	1,800	0.00	0	13,900	300	13,900	2.16	0
MZ II and VII–WB & CP	**17,476,000**	**431,400**	**17,395,000**	**2.47**	**100**	**19,200,200**	**483,200**	**19,062,400**	**2.52**	**99.28**
BLM	9,021,200	209,600	8,993,500	2.32	52	9,012,500	188,800	8,948,200	2.09	47
Forest Service	162,000	2,900	160,700	1.79	1	452,500	5,600	420,300	1.24	2
Tribal and Other Federal	784,000	17,100	769,100	2.18	4	1,354,600	28,600	1,341,700	2.11	7
Private	6,233,900	170,800	6,200,300	2.74	36	7,394,800	236,700	7,370,400	3.20	39
State	1,244,800	30,200	1,241,300	2.43	7	979,800	23,400	975,800	2.39	5
Other	30,100	900	30,100	2.99	0	6,000	200	6,000	3.33	0
MZ III–SGB	**10,028,500**	**211,700**	**9,599,100**	**2.11**	**96**	**3,970,100**	**71,700**	**3,772,500**	**1.81**	**95.02**
BLM	6,309,400	115,700	6,003,000	1.83	63	3,199,800	56,900	3,061,200	1.78	81
Forest Service	1,236,200	20,900	1,180,700	1.69	12	356,200	4,400	331,100	1.24	9
Tribal and Other Federal	260,800	8,800	260,600	3.37	3	29,100	600	28,000	2.06	1
Private	1,836,200	56,800	1,774,400	3.09	18	384,800	9,800	352,000	2.55	9
State	385,900	9,400	380,200	2.44	4	200	0	200	0.00	0
MZ IV–SRP	**21,930,600**	**351,700**	**20,890,500**	**1.60**	**95**	**10,958,500**	**187,900**	**10,638,900**	**1.71**	**97.08**
BLM	13,710,700	199,400	13,075,200	1.45	63	4,928,200	68,500	4,799,300	1.39	45
Forest Service	1,613,800	20,100	1,479,200	1.25	7	1,113,500	12,900	1,047,800	1.16	10
Tribal and Other Federal	633,600	11,200	628,200	1.77	3	522,500	8,000	449,300	1.53	4
Private	4,890,200	100,900	4,643,900	2.06	22	3,516,700	83,500	3,485,800	2.37	33
State	1,019,400	18,800	1,001,100	1.84	5	846,200	14,100	825,300	1.67	8
Other	62,900	1,200	62,900	1.91	0	31,400	800	31,400	2.55	0

Table 6. Summary of the direct and indirect influences of roads* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**88,100**	**6,608,800**	**1.24**	**93**	**5,808,000**	**99,100**	**5,636,800**	**1.71**	**97.05**
BLM	5,117,500	54,300	4,724,400	1.06	71	4,196,700	59,900	4,034,200	1.43	72
Forest Service	62,200	2,000	62,200	3.22	1	114,900	3,600	114,900	3.13	2
Tribal and Other Federal	717,100	6,900	639,800	0.96	10	101,800	2,200	99,500	2.16	2
Private	798,000	17,400	788,600	2.18	12	1,199,000	29,400	1,194,600	2.45	21
State	64,900	1,300	64,200	2.00	1	115,800	2,100	115,600	1.81	2
Other	337,500	6,200	329,500	1.84	5	79,800	1,900	77,900	2.38	1

*Data Source: Tele Atlas ESRI StreetMap Premium for ArcGIS v 9.0, 2008

[1]Direct footprint is the co-location of roads within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence of roads was calculated using 7.5 km for interstates and 3km for highways, primary routes, and secondary routes. (Connelly and others, 2004, Holloran, 2005; Lyon, 2000).

[2]For each MZ, calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

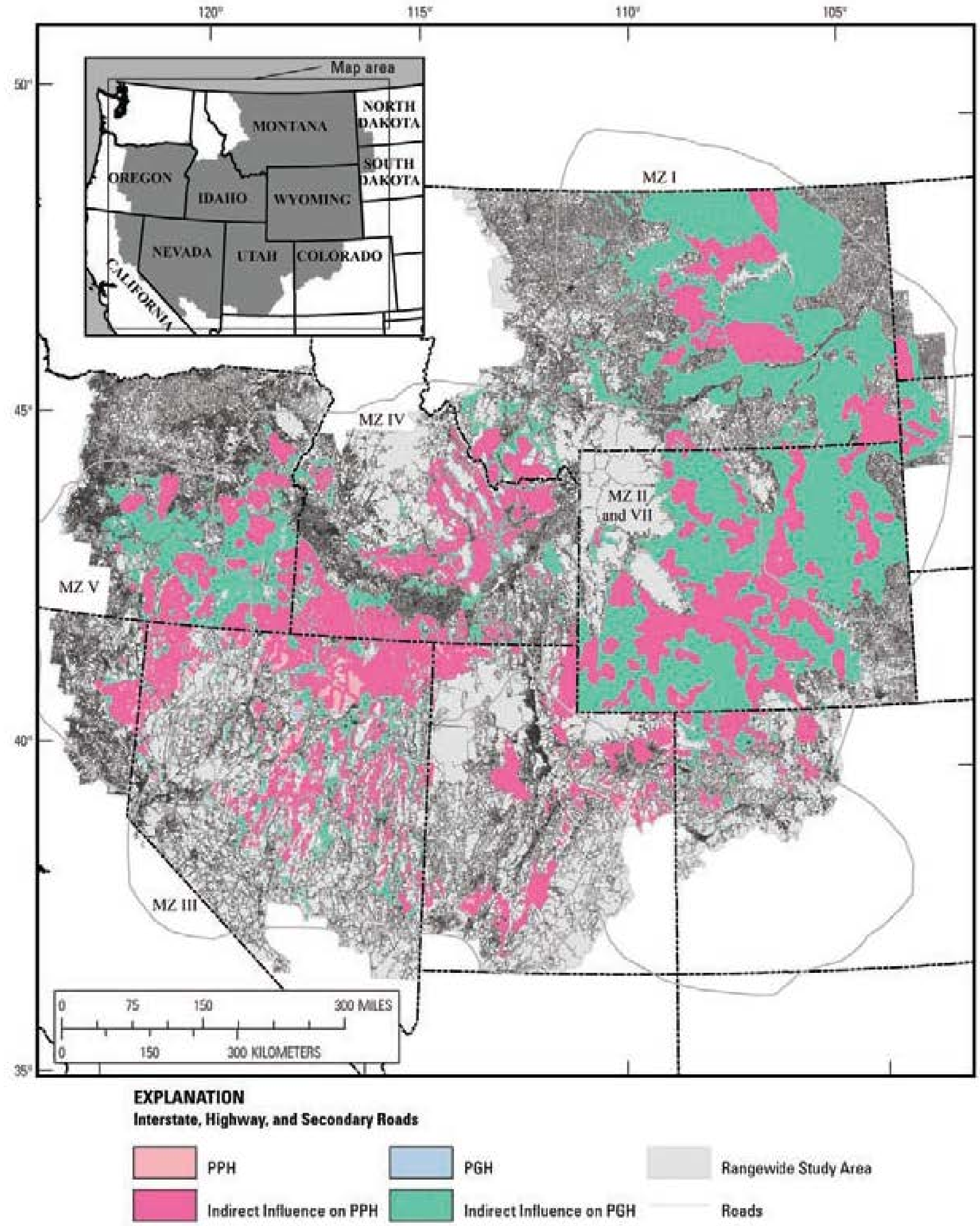

Figure 11. Overlap of roads and potential indirect influences of roads and sage-grouse preliminary priority and general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 7. Summary of the direct influences of abandoned and non-abandoned, railroads* and indirect influences of non-abandoned railroads across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	3 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	3 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**1,500**	**235,400**	**0.01**	**2.02**	**34,663,000**	**11,800**	**2,493,800**	**0.03**	**7.19**
BLM	2,994,300	100	14,300	0.00	6	4,524,900	400	130,500	0.01	5
Forest Service	292,400	0	3,000	0.00	1	515,300	200	63,900	0.04	3
Tribal and Other Federal	219,700	0	0	0.00	0	2,427,700	600	165,000	0.02	7
Private	7,132,500	1,300	200,100	0.02	85	24,682,800	9,900	1,983,500	0.04	80
State	995,600	100	17,900	0.01	8	2,498,400	700	149,500	0.03	6
Other	1,900	0	100	0.00	0	13,900	0	1,400	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**3,100**	**586,500**	**0.02**	**3.36**	**19,200,200**	**7,800**	**1,718,200**	**0.04**	**8.95**
BLM	9,021,200	900	202,600	0.01	35	9,012,500	1,700	539,100	0.02	31
Forest Service	162,000	0	200	0.00	0	452,500	0	300	0.00	0
Tribal and Other Federal	784,000	100	6,800	0.01	1	1,354,600	300	69,900	0.02	4
Private	6,233,900	1,900	339,000	0.03	58	7,394,800	5,500	1,022,800	0.07	60
State	1,244,800	200	33,000	0.02	6	979,800	400	86,100	0.04	5
Other	30,100	0	5,000	0.00	1	6,000	0	0	0.00	0
MZ III–SGB	**10,028,500**	**2,300**	**408,700**	**0.02**	**4.08**	**3,970,100**	**200**	**61,000**	**0.01**	**1.54**
BLM	6,309,400	500	149,700	0.01	37	3,199,800	200	43,200	0.01	71
Forest Service	1,236,200	0	10,000	0.00	2	356,200	0	0	0.00	0
Tribal and Other Federal	260,800	400	37,000	0.15	9	29,100	0	0	0.00	0
Private	1,836,200	1,100	174,100	0.06	43	384,800	100	17,800	0.03	29
State	385,900	200	37,900	0.05	9	200	0	0	0.00	0
MZ IV–SRP	**21,930,600**	**2,100**	**316,600**	**0.01**	**1.44**	**10,958,500**	**3,000**	**436,300**	**0.03**	**3.98**
BLM	13,710,700	1,000	138,500	0.01	44	4,928,200	900	175,800	0.02	40
Forest Service	1,613,800	100	17,000	0.01	5	1,113,500	0	4,600	0.00	1
Tribal and Other Federal	633,600	100	36,500	0.02	12	522,500	100	10,400	0.02	2
Private	4,890,200	800	114,500	0.02	36	3,516,742	1,900	223,000	0.05	51
State	1,019,373	100	10,000	0.01	3	846,200	100	22,400	0.01	5
Other	62,900	0	100	0.00	0	31,400	0	100	0.00	0

Table 7. Summary of the direct influences of abandoned and non-abandoned, railroads* and indirect influences of non-abandoned railroads across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	**SG Habitat (acres)**	**Direct Footprint[1] (acres)**	**3 km Indirect Influence[1] (acres)**	**Direct Footprint[1] (%)**	**Relative Influence[2] (%)**	**SG Habitat (acres)**	**Direct Footprint[1] (acres)**	**3 km Indirect Influence[1] (acres)**	**Direct Footprint[1] (%)**	**Relative Influence[2] (%)**
MZ V–NGB	**7,097,200**	**500**	**6,800**	**0.01**	**0.10**	**5,808,000**	**200**	**14,000**	**0.00**	**0.24**
BLM	5,117,500	200	2,400	0.00	35	4,196,700	0	7,500	0.00	54
Forest Service	62,200	0	0	0.00	0	114,900	0	0	0.00	0
Tribal and Other Federal	717,100	0	4,100	0.00	60	101,800	0	100	0.00	1
Private	798,000	0	100	0.00	1	1,199,000	100	4,500	0.01	32
State	64,900	0	0	0.00	0	115,800	0	0	0.00	0
Other	337,500	200	300	0.06	4	79,800	0	1,900	0.00	14

*Data Source: Federal Railroad Administration (FRA) Rail Lines of the of the U.S.A., 2001.

[1]Direct footprint is the co-location of rail lines (abandoned and non-abandoned) within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from estimated spread of exotic plants (Knick and others, 2011).

[2]For each MZ, these were calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, these were calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

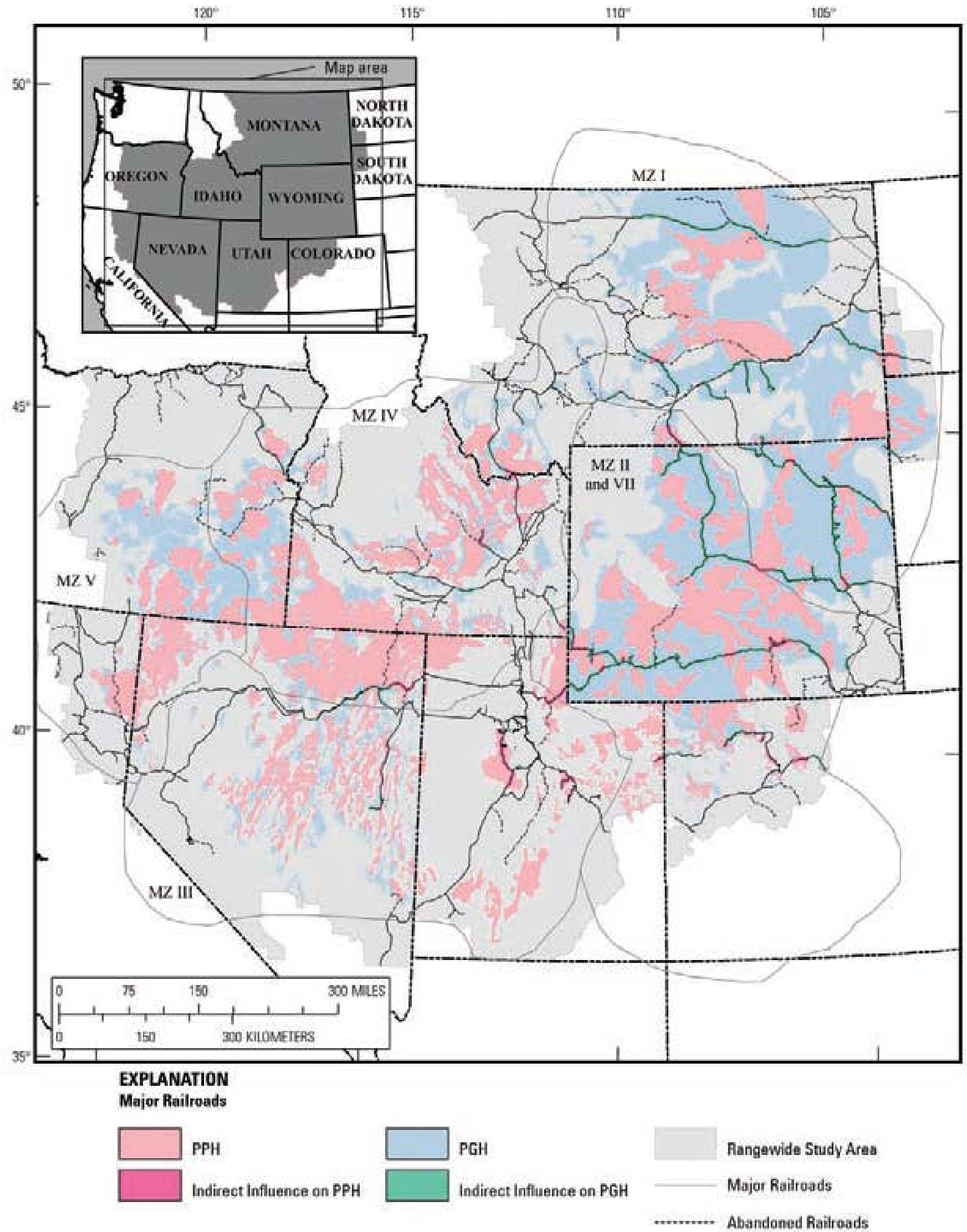

Figure 12. Overlap of abandoned and non-abandoned railroads, potential indirect influences of non-abandoned railroads, and sage-grouse preliminary priority and general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 8. Summary of the distribution of power transmission lines (>115 kilovolt)[*] across sage-grouse habitats (PPH and PGH) by Management Zone (MZ).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH					PGH				
	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**128,700**	**3,348,700**	**1.11**	**28.78**	**34,663,000**	**1,082,400**	**16,029,400**	**3.12**	**46.24**
BLM	2,994,300	18,600	601,600	0.62	18	4,524,900	71,300	1,482,800	1.58	9
Forest Service	292,400	3,800	136,300	1.30	4	515,300	16,700	270,100	3.24	2
Tribal and Other Federal	219,700	1,000	34,600	0.46	1	2,427,700	90,600	1,459,500	3.73	9
Private	7,132,500	92,100	2,280,300	1.29	68	24,682,800	831,100	11,655,300	3.37	73
State	995,600	13,200	295,600	1.33	9	2,498,400	71,400	1,156,600	2.86	7
Other	1,900	0	300	0.00	0	13,900	1,300	5,000	9.35	0
MZ II and VII–WB & CP	**17,476,000**	**673,800**	**10,480,800**	**3.86**	**59.97**	**19,200,200**	**961,700**	**12,051,000**	**5.01**	**62.76**
BLM	9,021,200	320,500	5,286,400	3.55	50	9,012,500	392,800	5,430,900	4.36	45
Forest Service	162,000	5,300	91,900	3.27	1	452,500	7,100	137,400	1.57	1
Tribal and Other Federal	784,000	13,000	339,900	1.66	3	1,354,600	62,100	760,700	4.58	6
Private	6,233,900	284,400	4,033,300	4.56	38	7,394,800	454,900	5,120,900	6.15	42
State	1,244,800	48,100	711,200	3.86	7	979,800	44,700	597,900	4.56	5
Other	30,100	2,400	18,100	7.97	0	6,000	200	3,200	3.33	0
MZ III–SGB	**10,028,500**	**181,700**	**3,346,700**	**1.81**	**33.37**	**3,970,100**	**43,200**	**1,001,500**	**1.09**	**25.23**
BLM	6,309,400	84,500	1,775,800	1.34	53	3,199,800	36,900	801,500	1.15	80
Forest Service	1,236,200	5,500	211,700	0.44	6	356,200	800	46,500	0.22	5
Tribal and Other Federal	260,800	1,300	92,100	0.50	3	29,100	0	1,700	0.00	0
Private	1,836,200	80,100	1,074,900	4.36	32	384,800	5,500	151,600	1.43	15
State	385,900	10,200	192,100	2.64	6	200	0	200	0.00	0
MZ IV–SRP	**21,930,600**	**392,600**	**8,015,200**	**1.79**	**36.55**	**10,958,500**	**266,300**	**4,204,300**	**2.43**	**38.37**
BLM	13,710,700	234,900	4,973,200	1.71	62	4,928,200	112,200	1,795,300	2.28	43
Forest Service	1,613,800	13,000	400,700	0.81	5	1,113,500	7,900	313,000	0.71	7
Tribal and Other Federal	633,600	17,400	245,500	2.75	3	522,500	7,900	149,000	1.51	4
Private	4,890,200	106,700	2,035,600	2.18	25	3,516,742	116,200	1,619,700	3.30	39
State	1,019,373	15,900	301,900	1.56	4	846,200	20,500	302,300	2.42	7
Other	62,900	4,800	58,200	7.63	1	31,400	1,700	24,900	5.41	1

Table 8. Summary of the distribution of power transmission lines (>115 kilovolt)[*] across sage-grouse habitats (PPH and PGH) by Management Zone (MZ).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**77,100**	**1,814,200**	**1.09**	**25.56**	**5,808,000**	**88,900**	**1,922,400**	**1.53**	**33.10**
BLM	5,117,500	59,500	1,403,800	1.16	77	4,196,700	60,000	1,237,000	1.43	64
Forest Service	62,200	200	15,400	0.32	1	114,900	2,100	45,800	1.83	2
Tribal and Other Federal	717,100	0	10,500	0.00	1	101,800	900	24,800	0.88	1
Private	798,000	12,600	238,700	1.58	13	1,199,000	21,500	521,300	1.79	27
State	64,900	300	31,700	0.46	2	115,800	3,200	67,600	2.76	4
Other	337,500	4,500	114,100	1.33	6	79,800	1,300	25,800	1.63	1

[*]Data Source: EV Energy Map, Platts/Global Energy, 2005 ICBEMP Existing Utility Corridors, 2003.

[1]Direct footprint is the co-location of power lines within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from foraging distances of predators (Boarman and Heinrich, 1999; Leu and others, 2008).

[2]For each MZ, these were calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

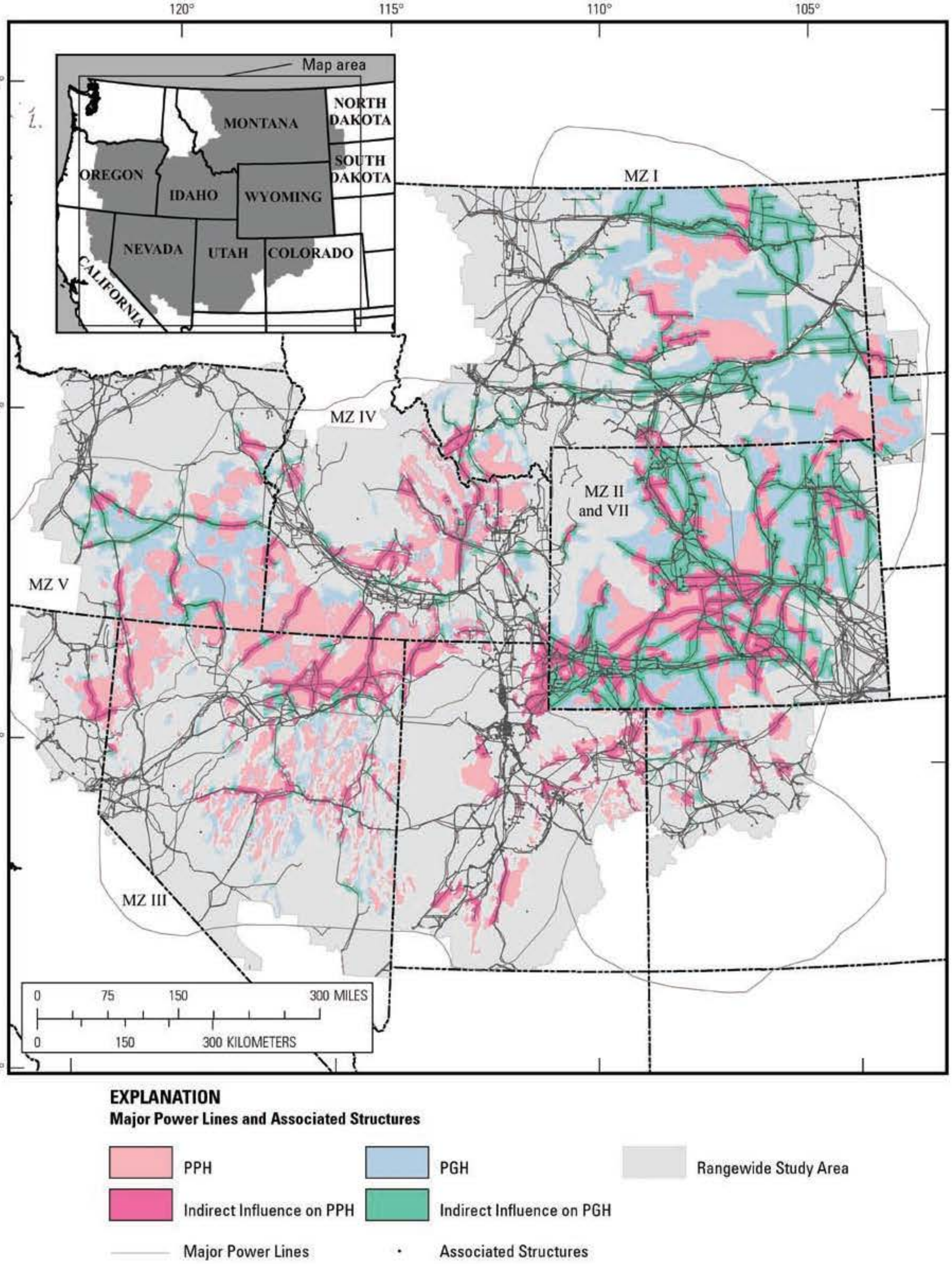

Figure 13*A*. Overlap of major power lines and associated infrastructure, indirect influences of these structures, and preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

673,800 acres (2,725 km^2; 3.9 percent) of priority habitats and 961,700 acres (3,900 km^2; 5.0 percent) of general habitats directly influenced in MZs II and VII—the largest among MZs. Indirect impacts of power lines—estimated using the spatial foraging scale of avian predators, which may be attracted to power lines (4.3 mi [6.9 km])—are estimated to influence approximately 44 percent of priority and general habitats throughout the species' range, and approximately 60 percent of priority habitats in MZs II and VII. Collectively, BLM lands account for approximately 48 percent of the priority habitats indirectly influenced by major power lines.

Nonwind-power-related vertical structures are widespread and directly influence approximately 15,200 acres (61 km^2; 0.01 percent) of sage-grouse habitat throughout the range of the species (table 9; fig. 13*B*). A minimum of 10,182 communication towers exist in or within 50 km (30 mi) of current sage-grouse range (Knick and Connelly, 2011a). Indirect effects of vertical structures—similarly, estimated using the spatial-foraging scale of sage-grouse avian predators, which may be attracted to these structures (6.9 km [4.3 mi]; Boarman and Heinrich, 1999; Leu and others, 2008)—influence approximately 33.4 percent of priority habitats throughout the range of the species, so the potential indirect effects of vertical structures are not insignificant (table 9, fig. 13*B*). BLM lands account for approximately 45 percent of the priority habitats indirectly influenced by vertical structures. Fences are ubiquitous throughout sage-grouse range (fig. 13*C*), with areas having fence densities exceeding 4 mi/1,000 acres (1.5 km/km^2) in all MZs except western portions of MZ III (Knick and Connelly, 2011a). Approximately 167,700 mi (270,000 km) of fence are present within BLM- and USFS-managed allotment and pasture boundaries on sage-grouse habitats, with approximately 78,300 mi (126,000 km) of fence present on these public lands, in priority habitats (table 10; fig. 13*C*). These estimates of fence densities across the range of the species are approximately 0.75 miles per section (one section equals one square mile) and exceed 1 mi/section (1.2 km/2.6 km^2) in priority habitats in MZ I, without accounting for similar fencing on private lands.

Compared to occupied range, extirpated sage-grouse range was 60 percent closer to highways and had 25 percent higher densities of roads compared to occupied range (Wisdom and others, 2011). Mean distance to transmission lines was more than two times farther in occupied range than in extirpated range, and the distance to communication towers averaged almost two times as far in occupied versus extirpated range (Wisdom and others, 2011). Although relatively few leks across the range of the species had interstate highways nearby, declines in the numbers of males on leks closer to interstates were slightly less than those farther from interstates; nonetheless, there was a consistent downward trend in sage-grouse numbers as the length of interstate within 3.1 mi (5 km) increased (Johnson and others, 2011). Similarly, despite low numbers of communication towers across the sagebrush biome, sage-grouse lek trends across the range of the species generally increased with distance from nearest tower and generally decreased with increasing numbers of towers within 5 km (3.1 mi) and 18 km (11.2 mi) of leks (Johnson and others, 2011). Sage-grouse population response to a human footprint metric (see Section III.A) indicated that sage-grouse generally respond negatively to increased anthropogenic infrastructures located in sagebrush habitats. Roads and power lines are especially widespread throughout the range of the species, and communication towers are becoming increasingly prevalent. Although the response of sage-grouse to communication towers may be correlated with human development in general (towers are often concentrated along major roadways and around urban centers; Johnson and others, 2011), an extensive rural network exists, and with potential for an increase in these types of structures throughout the sagebrush biome with ongoing development (for example, meteorological towers at proposed wind developments), the accumulation of factors (traffic, predator accessibility, and invasive species) is likely to have effects on sage-grouse habitat quality.

Lekking and nesting sage-grouse appear to avoid road infrastructure and related activities (especially traffic). Along Interstate 80 in Wyoming and Utah between 1970 and 2003, observers found no leks within 2 km (1.25 mi) of the interstate and fewer birds on leks within 7.5 km (4.7 mi) than within 7.5–15 km (4.7–9.3 mi) beyond the interstate (Connelly and others, 2004). Additionally, there were higher rates of decline in lek counts within 7.5 km than beyond 7.5 km of the interstate. Negative relations between the length of road segments within 3.2 km (2 mi) of leks and the probability of lek occurrence were found in Montana and southern Canada with the impacts of increasing road lengths (implying larger roads) being greatest for larger leks (>25 males); the probability of occurrence of a large lek approached 0 percent as the length of road segments within 3.2 km (2 mi) of a lek exceeded 100 km (62 mi; Tack 2009).

Generally, road-effect distances (the distance from a road at which a population density decrease is detected) are positively correlated with increased traffic density and speed (Forman and Alexander, 1998). The upgrade of haul roads associated with surface coal mining activity in Colorado resulted in increased traffic levels and was correlated with declines in the number of displaying males on sage-grouse leks situated within 2 km (1.25 mi) of the road (Remington and Braun, 1991). Rates of decline in sage-grouse male lek attendance increased as traffic volumes on roads near leks increased, and vehicle activity on roads during the daily strutting period (that is, early morning) had a greater influence on male lek attendance compared to roads with no vehicle activity during early morning in southwestern Wyoming (Holloran, 2005). In central Wyoming, peak male attendance (that is, abundance) at leks experimentally treated with noise recorded at roads in a gas field decreased 73 percent relative to paired controls (Blickley, 2012).

Sage-grouse avoided nesting and summering near major roads (for example, paved secondary highways) in south-central Wyoming (LeBeau, 2012), and traffic disturbance (1 to 12 vehicles/day) within 3 km (1.9 mi) of leks during the

Table 9. Summary of the direct and indirect influences of communication towers and other (non-wind) vertical structures* across preliminary priority and preliminary general habitat.

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**400**	**3,969,600**	**0.00**	**34**	**34,663,000**	**5,700**	**19,294,600**	**0.02**	**55.66**
BLM	2,994,300	0	665,300	0.00	17	4,524,900	200	1,891,000	0.00	10
Forest Service	292,400	0	104,500	0.00	3	515,300	100	279,300	0.02	1
Tribal and Other Federal	219,700	0	18,800	0.00	0	2,427,700	400	1,596,300	0.02	8
Private	7,132,500	300	2,881,200	0.00	73	24,682,800	4,700	14,125,500	0.02	73
State	995,600	0	299,300	0.00	8	2,498,400	200	1,397,000	0.01	7
Other	1,900	0	400	0.00	0	13,900	0	5,300	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**1,500**	**7,395,100**	**0.01**	**42**	**19,200,200**	**4,600**	**10,775,800**	**0.02**	**56.12**
BLM	9,021,200	500	3,309,100	0.01	45	9,012,500	1,100	4,540,700	0.01	42
Forest Service	162,000	0	67,400	0.00	1	452,500	0	177,700	0.00	2
Tribal and Other Federal	784,000	100	322,200	0.01	4	1,354,600	100	685,500	0.01	6
Private	6,233,900	700	3,176,100	0.01	43	7,394,800	3,100	4,828,200	0.04	45
State	1,244,800	100	507,100	0.01	7	979,800	200	541,600	0.02	5
Other	30,100	0	13,100	0.00	0	6,000	0	2,200	0.00	0
MZ III–SGB	**10,028,500**	**800**	**3,420,700**	**0.01**	**34**	**3,970,100**	**200**	**1,073,500**	**0.01**	**27.04**
BLM	6,309,400	200	1,595,600	0.00	47	3,199,800	100	756,000	0.00	70
Forest Service	1,236,200	100	377,500	0.01	11	356,200	0	68,900	0.00	6
Tribal and Other Federal	260,800	0	121,300	0.00	4	29,100	0	9,800	0.00	1
Private	1,836,200	500	1,154,200	0.03	34	384,800	100	238,600	0.03	22
State	385,900	0	172,000	0.00	5	200	0	200	0.00	0
MZ IV–SRP	**21,930,600**	**800**	**6,818,700**	**0.00**	**31**	**10,958,500**	**900**	**4,544,900**	**0.01**	**41.47**
BLM	13,710,700	400	3,876,700	0.00	57	4,928,200	300	1,551,000	0.01	34
Forest Service	1,613,800	0	460,400	0.00	7	1,113,500	100	359,500	0.01	8
Tribal and Other Federal	633,600	0	280,400	0.00	4	522,500	100	153,000	0.02	3
Private	4,890,200	300	1,859,100	0.01	27	3,516,742	400	2,078,800	0.01	46
State	1,019,373	0	326,300	0.00	5	846,200	100	385,100	0.01	8
Other	62,900	0	15,800	0.00	0	31,400	0	17,500	0.00	0

Table 9. Summary of the direct and indirect influences of communication towers and other (non-wind) vertical structures* across Management Zones (MZ) by acres of PPH and PGH.—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**100**	**1,164,400**	**0.00**	**16**	**5,808,000**	**200**	**1,224,900**	**0.00**	**21.09**
BLM	5,117,500	100	727,000	0.00	62	4,196,700	100	705,100	0.00	58
Forest Service	62,200	0	6,800	0.00	1	114,900	0	46,100	0.00	4
Tribal and Other Federal	717,100	0	45,800	0.00	4	101,800	0	17,600	0.00	1
Private	798,000	0	217,300	0.00	19	1,199,000	100	412,000	0.01	34
State	64,900	0	11,600	0.00	1	115,800	0	10,700	0.00	1
Other	337,500	0	155,900	0.00	13	79,800	0	33,400	0.00	3

*Data Source: Federal Communications Commission, 2009; Federal Aviation Administration Digital Obstacles File, 2011.

[1]Direct footprint is the co-location of communication towers within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from foraging distances of predators (Boarman and Heinrich, 1999; Leu and others, 2008).

[2]For each MZ, calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, these were calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

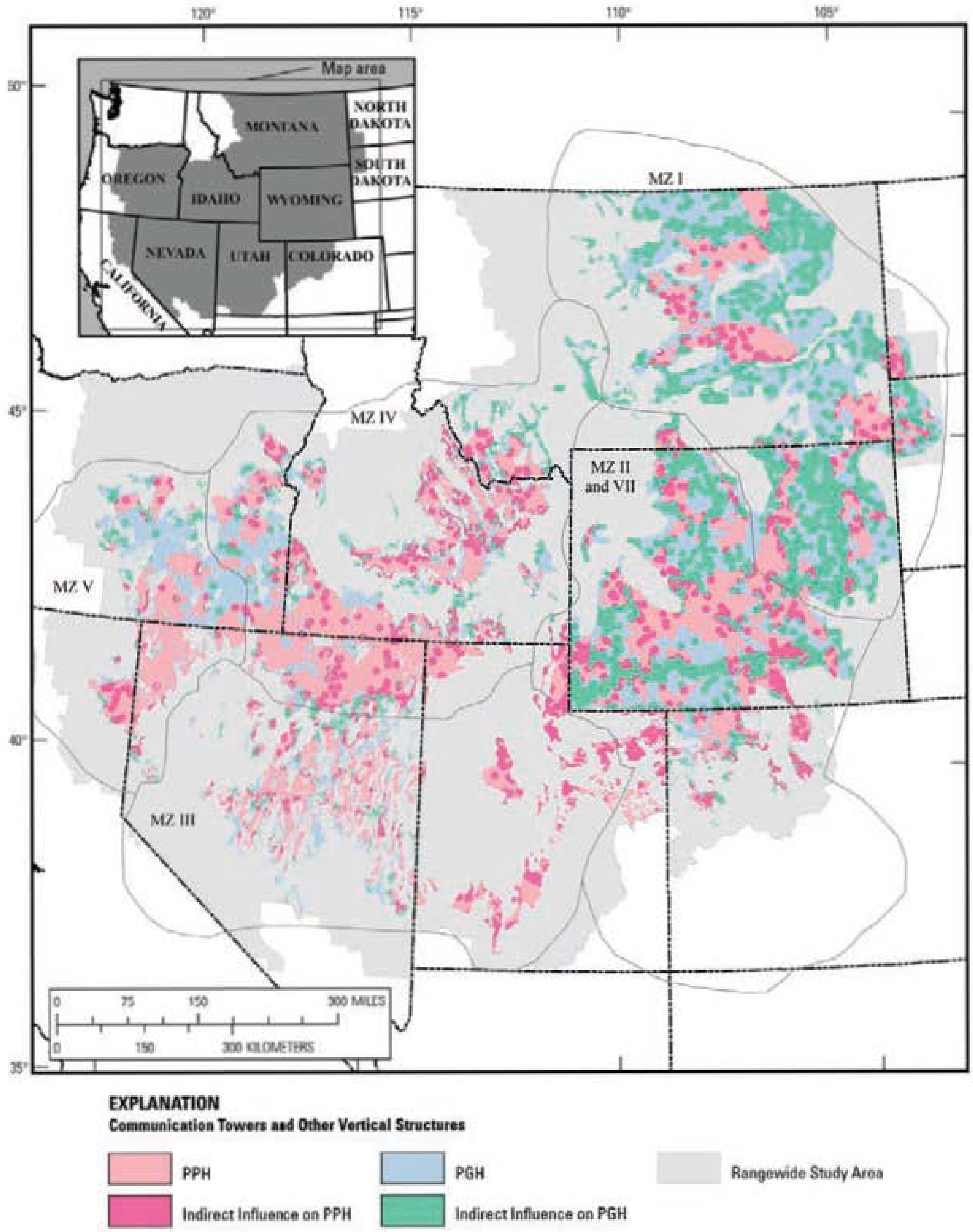

Figure 13*B*. Overlap of communication towers and other vertical structures (non-wind), potential indirect influences of these structures, and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 10. Summary of the influence of fences* across Management Zones (MZ) by miles within preliminary priority and preliminary general habitats (PPH and PGH, respectively) using Bureau of Land Management and U.S. Forest Service allotment and pasture boundaries as a surrogate for fence locations.

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH			PGH		
	SG Habitat (acres)	Direct Footprint (miles)	Average miles per section	SG Habitat (acres)	Direct Footprint (miles)	Average miles per section
MZ I–GP	**11,636,400**	**18,700**	**1.03**	**34,663,000**	**48,200**	**0.89**
BLM	2,994,300	6,100	1.30	4,524,900	11,300	1.60
Forest Service	292,400	500	1.09	515,300	900	1.12
Tribal and Other Federal	219,700	100	0.29	2,427,700	500	0.13
Private	7,132,500	10,700	0.96	24,682,800	32,100	0.83
State	995,600	1,400	0.90	2,498,400	3,300	0.85
Other	1,900	0	0.00	13,900	0	0.00
MZ II and VII–WB & CP	**17,476,000**	**18,300**	**0.67**	**19,200,200**	**18,900**	**0.63**
BLM	9,021,200	9,300	0.66	9,012,500	8,800	0.62
Forest Service	162,000	500	1.98	452,500	1,100	1.56
Tribal and Other Federal	784,000	400	0.33	1,354,600	500	0.24
Private	6,233,900	6,700	0.69	7,394,800	7,400	0.64
State	1,244,800	1,300	0.67	979,800	1,100	0.72
Other	30,100	0	0.00	6,000	0	0.00
MZ III–SGB	**10,028,500**	**7,800**	**0.50**	**3,970,100**	**3,000**	**0.48**
BLM	6,309,400	4,700	0.48	3,199,800	2,000	0.40
Forest Service	1,236,200	1,700	0.88	356,200	600	1.08
Tribal and Other Federal	260,800	100	0.25	29,100	0	0.00
Private	1,836,200	1,100	0.38	384,800	300	0.50
State	385,900	300	0.50	200	0	0.00
MZ IV–SRP	**21,930,600**	**27,900**	**0.81**	**10,958,500**	**13,900**	**0.81**
BLM	13,710,700	16,100	0.75	4,928,200	7,200	0.94
Forest Service	1,613,800	2,800	1.11	1,113,500	1,900	1.09
Tribal and Other Federal	633,600	400	0.40	522,500	400	0.49
Private	4,890,200	7,400	0.97	3,516,742	3,900	0.71
State	1,019,373	1,200	0.75	846,200	500	0.38
Other	62,900	0	0.00	31,400	0	0.00
MZ V–NGB	**7,097,200**	**5,600**	**0.50**	**5,808,000**	**5,400**	0.60
BLM	5,117,500	4,000	0.50	4,196,700	3,600	0.55
Forest Service	62,200	100	1.03	114,900	200	1.11
Tribal and Other Federal	717,100	100	0.09	101,800	100	0.63
Private	798,000	1,000	0.80	1,199,000	1,400	0.75
State	64,900	100	0.99	115,800	100	0.55
Other	337,500	300	0.57	79,800	100	0.80

*Data Source: BLM GSSP grazing allotments and pastures, 2012; USFS Enterprise Data Warehouse, 2012. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

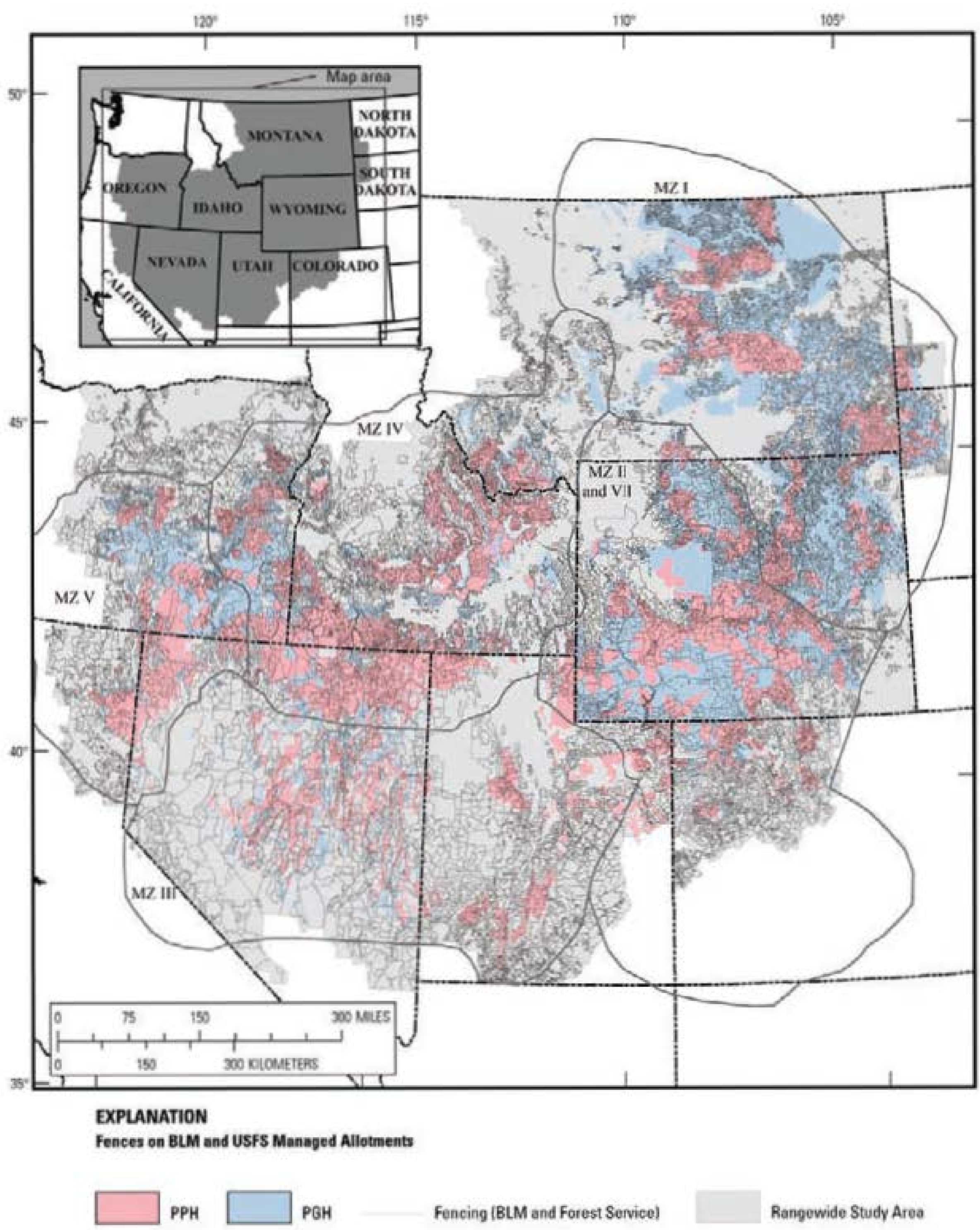

Figure 13*C*. Distribution of fences associated with Federally managed allotments across the sage-grouse study area, estimated from Bureau of Land Management and U.S. Forest Service pasture and allotment boundaries.

breeding season reduced nest-initiation rates and increased distances moved from leks during nest-site selection of female sage-grouse in southwestern Wyoming (Lyon and Anderson, 2003). Nesting propensity (that is, nest initiation rates) was 24 percent lower for females breeding on road-disturbed leks compared to undisturbed females. Fifty-six (56) percent of females breeding on disturbed leks initiated nests in consecutive years compared to 82 percent of females breeding on undisturbed leks; and females moved twice as far from leks to nest locations if breeding on disturbed leks (Lyon and Anderson 2003). Roads within 3 km (1.9 mi) of leks also negatively influence female habitat selection and fecundity. In summary, research suggests that roads within 7.5 km (4.7 mi) of leks negatively influence male lek attendance. Increased size of road, increased traffic levels on roads, and traffic activity during the early morning on roads within approximately 3 km (1.9 mi) of leks negatively influence male lek attendance as well as female behavior, nest-initiation, and nest success. Although minimal traffic volumes (<12 vehicles/day) on these roads negatively influence sage-grouse, higher traffic volumes appear to have a greater effect. The intermittent noise characteristic of traffic has been connected to declines in male lek attendance; however, details of causal relations have not been experimentally examined.

Transmission- and distribution-line construction (power lines) may result in substantial indirect habitat loss (that is, avoidance) due to sage-grouse avoidance of vertical structures, potentially because of changes in raptor concentrations and raptor species' composition relative to perches on flat landscapes. Additionally, the tendency of sage-grouse to fly relatively low, and in low light or when harried, may put them at a particularly high risk of collision with lines. Transmission lines generally refer to the high-voltage lines transferring electricity to substations, whereas distribution lines refer to lower voltage, smaller lines carrying electricity to consumers (we use "power lines" to refer to them collectively). The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years (Ellis, 1985). This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons (Ellis, 1985). Negative effects of power lines on lek persistence were documented in northeastern Wyoming; the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 4 mi (6.4 km) window around leks (Walker and others, 2007a). Braun (1998b) reported that use of areas near transmission lines by sage-grouse increased as distance from transmission lines increased up to 1970 ft (600 m). Sage-grouse avoided brood-rearing habitats within 2.9 mi (4.7 km) of transmission lines in south-central Wyoming (LeBeau, 2012). Power line collisions accounted for 33 percent of juvenile (1st winter) mortality in low-elevation areas in Idaho (Beck and others, 2006). In general, it appears sage-grouse may avoid habitats within 0.4–2.9 mi (0.6–4.7 km) of a transmission line, and erection of a transmission line close to a lek will negatively influence sage-grouse lek attendance and breeding-season behavior. Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse (Steenhof and others, 1993; Connelly and others, 2004). Foraging distances of avian, sage-grouse predators have been estimated at 4.3 mi (6.9 km; Knick and Connelly, 2011a), suggesting that transmission and power lines may influence sage-grouse at large spatial scales (Connelly and others, 2004; Cresswell and others, 2010). Based on these data, the direct footprint within any given MZ is relatively small (1.1–5.0 percent; table 8), but the area of relative influence is more extensive (25.2–62.8 percent PGH; table 8). Whereas theoretical effects are clear and logical, information relating sage-grouse response to transmission lines and distribution lines, or the effects of these lines on sage-grouse demographics, is not extensive.

Fences represent potential movement barriers (especially woven-wire fences), predator perches, or travel corridors and are a potential cause of direct mortality to sage-grouse (Braun, 1998). Theoretically, not every fence is a problem, and those that tend to cause problems typically include one or more of the following characteristics: (1) constructed with steel t-posts, (2) constructed near leks, (3) bisect winter concentration areas, or (4) border riparian areas (Christiansen, 2009). Areas of greater topographic relief (roughness) appear to have lower incidence of collisions apparently because the birds have to fly higher to avoid the ground (Christiansen, 2009). At broad spatial scales during the breeding season, fence collision risk was lower in areas with high topographic ruggedness, higher in areas with increased fence density on the landscape, decreased with increasing distance to nearest lek (impacts detected within approximately 2 km [1.25 mi] of leks), and increased with increasing lek size (Stevens and others, 2011; Stevens and others, 2012). Visibility of fences also influences collision rates, with greater rates associated with less visible fences, for example, those constructed using only steel t-posts (without wooden posts) and wider segment widths (more than 4 m (13 ft)) between posts (Stevens and others, 2011). Marking both sides of the top fence strand at 1 m intervals with reflective materials reduced collision frequency between 61 and 83 percent (Christiansen, 2009; Stevens and others, 2012). Decisions on the best design or treatment to mitigate collision risk must consider tradeoffs; for example, although wooden posts are more visible, they may provide better raptor perches than t-posts.

A5. Energy Development

Oil and gas development in habitats used by sage-grouse and construction of accompanying power lines, roads, and pipelines began in the late 1800s with the discovery of oil in the Interior West (Connelly and others, 2004). Since the 1960s, development of natural gas resources in this region has dominated the industry (Connelly and others, 2004). The United States National Energy Policy projects an increase in oil consumption by 33 percent, in natural gas consumption by >50 percent, and in electricity by 45 percent by 2025 (Connelly and others, 2004). Development of oil and gas resources requires construction (well pads, access roads, and ancillary infrastructure including flow lines, other roads, compressor stations, pumping stations, and electrical facilities), drilling and extraction, and transport of oil and gas (Connelly and others, 2004). The expected economic production life of coal bed methane wells is 12–18 years and of oil and deep-seam gas wells is 20–100 years with advanced technology (Connelly and others, 2004). Gas and oil wells are widespread throughout priority and general habitats with concentrated development areas exceeding 10 wells/section (1 mi^2 [2.6 km^2]) common throughout MZs I and II and the far eastern portions of MZ III (table 11, fig. 14), whereas current oil shale developments are concentrated solely in MZ VII (see Oil Shale Section, below). Despite significant closures of public lands to oil and gas leasing within PPH and PGH (table 12, fig. 15), current leases, including those leased but not yet developed, are substantial across sage-grouse ranges in MZs I and II (table 13, fig. 16*A*). Locations of geologic fields for traditional oil and gas (Copeland and others, 2011; fig. 16*B*) suggest potential development across eastern portions of the range (MZs I, II, VII, and eastern parts III); the potential for oil shale development is concentrated in MZs II and VII (see Oil Shale Section, below). It has been predicted that currently proposed and existing energy developments could affect more than 41 million hectares (24 percent) of shrubland habitats in the Western United States and Canada (Copeland and others, 2011). This may be a conservative estimate of impact for species sensitive to anthropogenic activity where the development of energy resources results in large-scale indirect habitat loss.

Notably, most research on the effects of energy development on sage-grouse has been focused in MZs I and II (Wyoming, Montana, Dakotas, and southern Canada) where development is concentrated. The relative consistency of distance and density effects of the infrastructure of gas and oil developments on sage-grouse across different development types—including shallow coal bed methane and deep gas and oil development (Naugle and others, 2011)—suggests results from these studies should be applicable elsewhere in the range. In 2011, fourteen studies were conducted investigating impacts of energy development on sage-grouse; all reported negative effects, whereas none reported a positive influence of development on populations or habitats (Naugle and others, 2011). Studies consistently reported that breeding populations of sage-grouse were negatively impacted at conventional well-pad densities of four and eight well pads/2.6 km^2 (1-mi^2 section), with declines in lek attendance by male sage-grouse ranging from 13 to 79 percent associated with these well densities (Harju and others, 2010; Naugle and others, 2011). Lek attendance declines have consistently been reported when well-pad densities exceed 1 pad/section (2.6 km^2 [1 mi^2]) within approximately 3.2 km (2 mi) of a lek (Naugle and others, 2011). Well-pad densities exceeding approximately 0.4 pads/section within 18 km (11 mi) of leks negatively influenced lek trends rangewide (Johnson and others, 2011), and larger leks (>25 males) did not occur in areas where well-pad densities exceeded 2.5 pads/section within 12.3 km (7.6 mi) of a lek (Tack, 2009). A recent study reported that the probability of lek persistence (that is, leks remaining active) approached 0 percent when well-pad densities exceeded approximately 6.5 pads/section (Hess and Beck, 2012).

A recent summary of studies investigating sage-grouse response to natural gas development reported that impacts to leks were most severe when infrastructure occurred near leks and were discernible out to distances of 6.2–6.4 km (3.8–4 mi; Naugle and others, 2011). However, negative impacts to male counts were observed as far as 12.3 km (7.6 mi) on large leks (>25 males) with additional impacts as far as 11 mi (18 km; the largest scale evaluated in literature, Naugle and others, 2011). Government imposed stipulations often restricted surface occupancy within 0.4 km (0.25 mi) of a lek during the time most studies were conducted, and leks that had ≥1 pad within this radius had 35 to 92 percent fewer attending males than did leks with zero wells within this distance (Harju and others, 2010; Naugle and others, 2011). It is also notable that a 1-km (0.6-mi) restricted-surface-occupancy buffer is currently applied during development of many energy fields. However excluding infrastructure within a 0.6-mi buffer may be ineffective for successful conservation because a negative response is still estimated with this density of development. These patterns were apparent when comparing developed areas in Wyoming, whereby gas and oil infrastructure encircling leks within smaller radii (≤1.6–2 km [1–1.25 mi]) had fewer sage-grouse compared to leks at which no infrastructure occurred within this distance (Harju and others, 2010). Additionally, there was a strong negative effect of natural gas development within 0.8–3.2 km (0.5–2 mi) on lek persistence in northwestern Wyoming (Walker and others, 2007a). Rates of decline in numbers of males occupying leks increased on leks located relatively centrally within a developing gas field—that is, leks surrounded by producing wells in three or more directions (Holloran, 2005). Peak male attendance (a surrogate for abundance) at leks experimentally treated with noise from natural gas drilling decreased 29 percent relative to paired controls (Blickley and others, 2012). Additionally, changes in the number of males occupying leks situated downwind of drilling rigs were more negative than those witnessed on leks upwind of drilling rigs, supporting evidence that increased noise intensity negatively influences male lek attendance (Holloran, 2005). A time lag—or a delay between activity associated with energy development and its measurable effects

Table 11. Summary of the direct influence of active and abandoned well sites and indirect influence of active oil and natural gas development-related wells* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**11,100**	**6,939,400**	**0.10**	**59.64**	**34,663,000**	**119,500**	**20,621,100**	**0.34**	**59.49**
BLM	2,994,300	2,000	1,528,400	0.07	22	4,524,900	18,200	2,402,800	0.40	12
Forest Service	292,400	400	276,600	0.14	4	515,300	1,000	370,200	0.19	2
Tribal and Other Federal	219,700	0	58,400	0.00	1	2,427,700	2,700	1,442,900	0.11	7
Private	7,132,500	8,000	4,479,200	0.11	65	24,682,800	88,800	14,874,800	0.36	72
State	995,600	600	595,800	0.06	9	2,498,400	8,800	1,521,100	0.35	7
Other	1,900	0	1,000	0.00	0	13,900	0	9,300	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**10,800**	**13,558,000**	**0.06**	**77.58**	**19,200,200**	**53,700**	**16,072,400**	**0.28**	**83.71**
BLM	9,021,200	6,300	7,375,300	0.07	54	9,012,500	32,000	8,079,600	0.36	50
Forest Service	162,000	0	41,400	0.00	0	452,500	100	143,100	0.02	1
Tribal and Other Federal	784,000	800	670,200	0.10	5	1,354,600	2,000	1,093,900	0.15	7
Private	6,233,900	3,100	4,493,600	0.05	33	7,394,800	16,500	5,974,300	0.22	37
State	1,244,800	700	952,600	0.06	7	979,800	3,100	775,600	0.32	5
Other	30,100	0	25,000	0.00	0	6,000	0	6,000	0.00	0
MZ III–SGB	**10,028,500**	**2,000**	**1,764,600**	**0.02**	**17.60**	**3,970,100**	**0**	**316,400**	**0.00**	**7.97**
BLM	6,309,400	500	663,800	0.01	38	3,199,800	0	252,700	0.00	80
Forest Service	1,236,200	0	209,400	0.00	12	356,200	0	7,800	0.00	2
Tribal and Other Federal	260,800	300	139,300	0.12	8	29,100	0	600	0.00	0
Private	1,836,200	900	697,600	0.05	40	384,800	0	55,200	0.00	17
State	385,900	300	54,500	0.08	3	200	0	100	0.00	0
MZ IV–SRP	**21,930,600**	**0**	**222,100**	**0.00**	**1.01**	**10,958,500**	**0**	**32,700**	**0.00**	**0.30**
BLM	13,710,700	0	123,000	0.00	55	4,928,200	0	14,800	0.00	45
Forest Service	1,613,800	0	0	0.00	0	1,113,500	0	0	0.00	0
Tribal and Other Federal	633,600	0	0	0.00	0	522,500	0	0	0.00	0
Private	4,890,200	0	99,100	0.00	45	3,516,700	0	17,900	0.00	55
State	1,019,400	0	0	0.00	0	846,200	0	0	0.00	0
Other	62,900	0	0	0.00	0	31,400	0	0	0.00	0

Table 11. Summary of the direct influence of active and abandoned well sites and indirect influence of active oil and natural gas development-related wells* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**0**	**0**	**0.00**	**0.00**	**5,808,000**	**0**	**0**	**0.00**	**0.00**
BLM	5,117,500	0	0	0.00	0	4,196,700	0	0	0.00	0
Forest Service	62,200	0	0	0.00	0	114,900	0	0	0.00	0
Tribal and Other Federal	717,100	0	0	0.00	0	101,800	0	0	0.00	0
Private	798,000	0	0	0.00	0	1,199,000	0	0	0.00	0
State	64,900	0	0	0.00	0	115,800	0	0	0.00	0
Other	337,500	0	0	0.00	0	79,800	0	0	0.00	0

*Data Source: BLM Automated Fluid Minerals Support System (AFMSS) Database, 2011, Enerdeq IHS database 2011. Direct and indirect impacts are calculated for the surface management entity; however, subsurface mineral rights may be severed from surface rights.

[1]Direct footprint is the co-location of active or plugged and abandoned oil and natural gas wells within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the active features and estimating the area affected. Indirect influence of active (non-abandoned) wells was estimated using the identified area of demographic impact (Johnson and others, 2011; Taylor and others, 2012).

[2]For each MZ, calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone, calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of acre estimates during calculations.

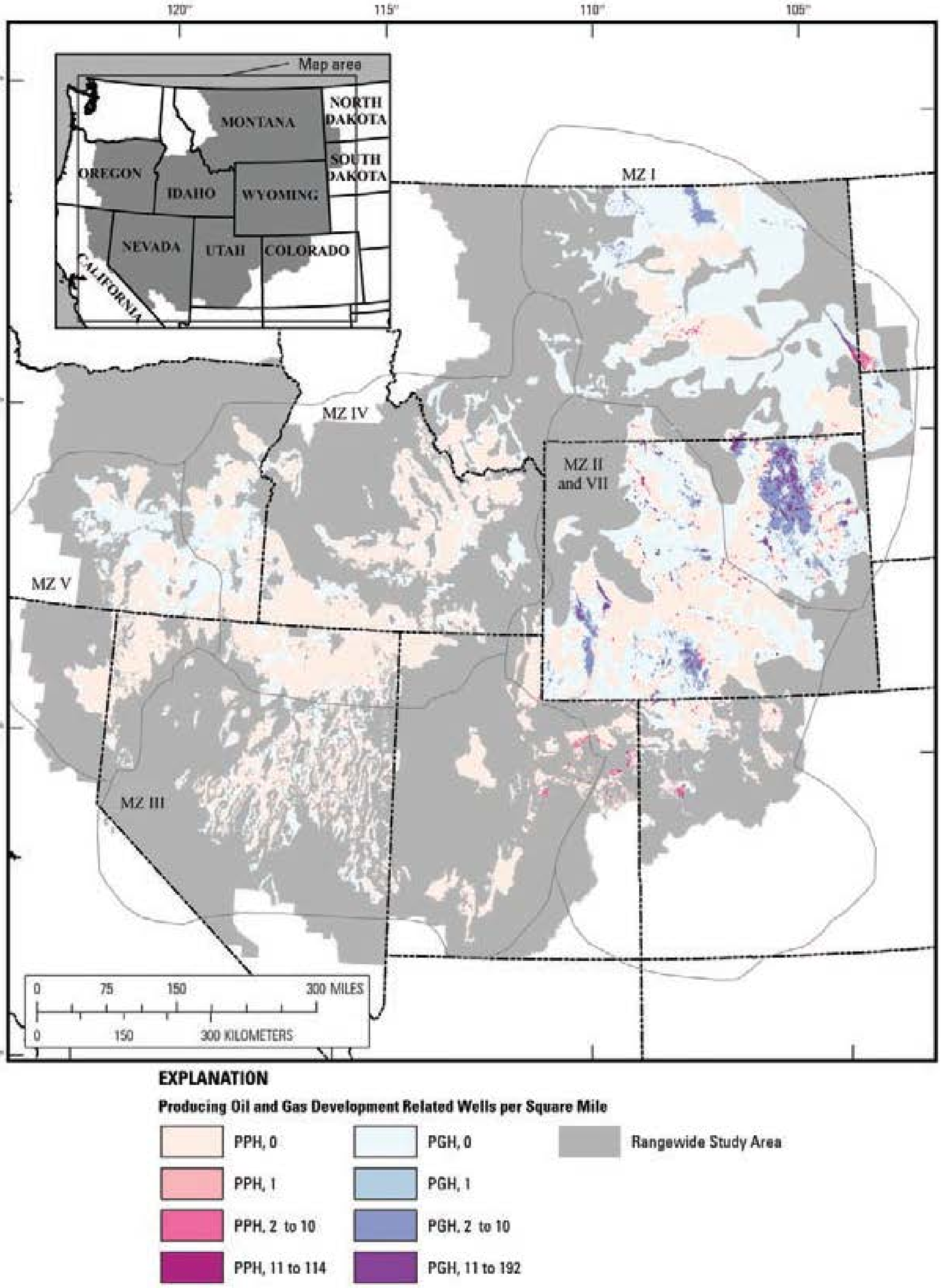

Figure 14. Density of active wells related to oil and gas development within preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 12. Summary of the areas closed to Federal oil and gas development across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats implicated (PPH and PGH, respectively).*

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone	PPH			PGH		
	SG Habitat (acres)	Federal Closed Areas (acres)	Federal Closed Areas (%)	SG Habitat (acres)	Federal Closed Areas (acres)	Federal Closed Areas (%)
MZ I–GP	11,636,400	170,900	1.47	34,663,000	668,300	1.93
MZ II and VII–WB & CP	17,476,000	1,302,400	7.45	19,200,200	1,242,400	6.47
MZ III–SGB	10,028,500	329,700	3.29	3,970,100	241,300	6.08
MZ IV–SRP	21,930,600	1,709,200	7.79	10,958,500	727,400	6.64
MZ V–NGB	7,097,200	744,000	10.48	5,808,000	82,400	1.42

*Data Source: Aggregated from individual Bureau of Land Management State Office Submissions in 2011 and 2012. Leased areas are calculated based on Federal subsurface management; however, subsurface mineral rights may be severed from surface rights. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

Table 13. Summary of existing Federal oil and gas leases (currently held by production or undeveloped) across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).*

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH			PGH		
	SG Habitat (acres)	Federal Leases (acres)	Federal Leases (% habitat type)	SG Habitat (acres)	Federal Leases (acres)	Federal Leases (% habitat type)
MZ I–GP	**11,636,400**	**1,304,600**	**11.21**	**34,663,000**	**5,016,800**	**14.47**
Leased–Held By Production		388,400	3.34		2,607,900	7.52
Leased–Undeveloped		916,200	7.87		2,408,900	6.95
MZ II and VII–WB & CP	**17,476,000**	**3,161,000**	**18.09**	**19,200,200**	**4,620,200**	**24.06**
Leased–Held By Production		680,500	3.89		2,134,600	11.12
Leased–Undeveloped		2,480,500	14.19		2,485,600	12.95
MZ III – SGB	**10,028,500**	**1,300,600**	**12.97**	**3,970,100**	**513,300**	**12.93**
Leased–Held By Production		39,000	0.39		1,300	0.03
Leased–Undeveloped		1,261,600	12.58		512,000	12.90
MZ IV – SRP	**21,930,600**	**245,900**	**1.12**	**10,958,500**	**100,200**	**0.91**
Leased–Held By Production		0	0.00		0	0.00
Leased–Undeveloped		245,900	1.12		100,200	0.91
MZ V – NGB	**7,097,200**	**0**	**0.00**	**5,808,000**	**0**	**0.00**

*Data Source: Aggregated from individual Bureau of Land Management State Office Submissions in 2011 and 2012. Leased areas are calculated based on Federal subsurface management; however, subsurface mineral rights may be severed from surface rights. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

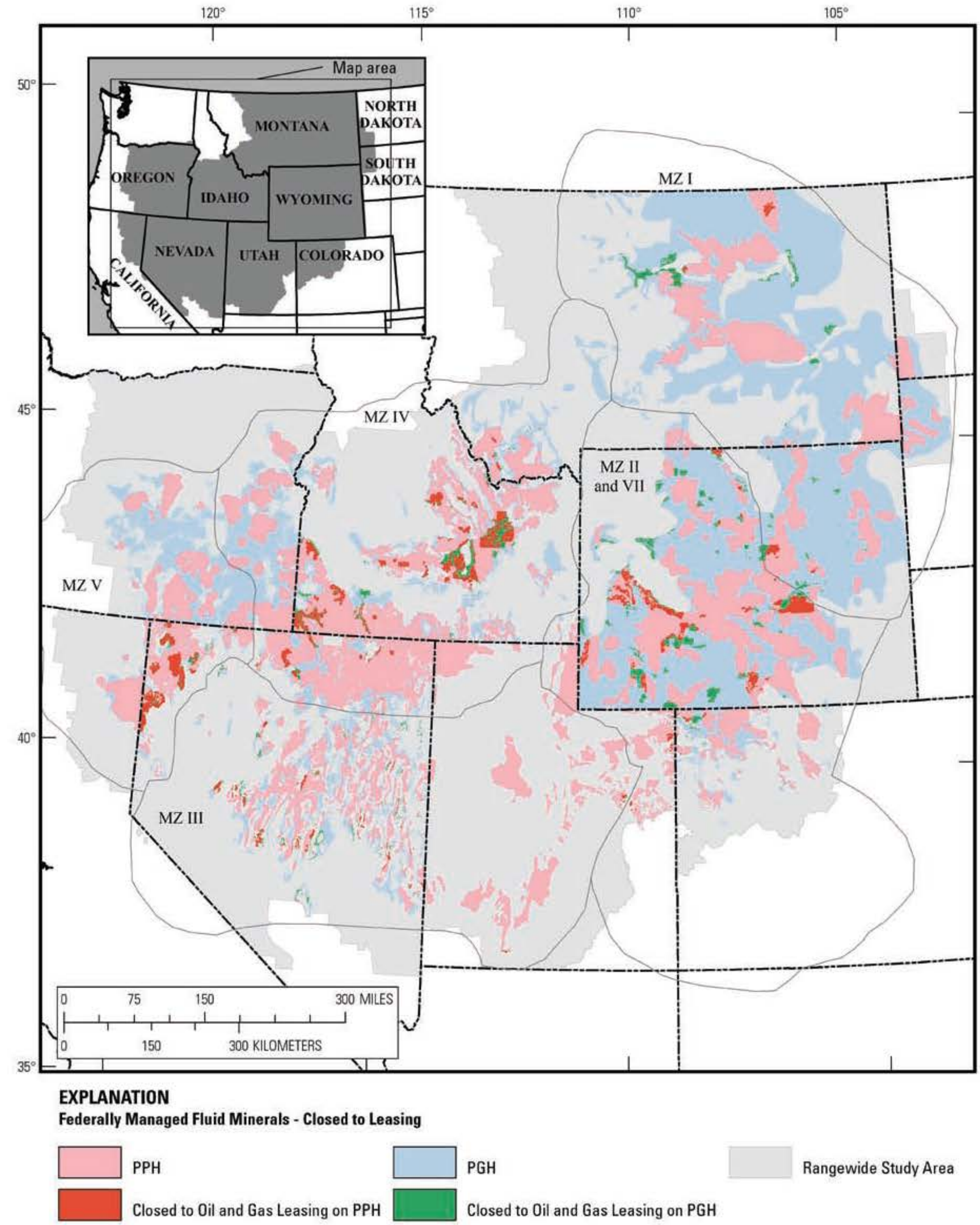

Figure 15. Overlap of Federally managed, subsurface acres closed to oil and gas leasing and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

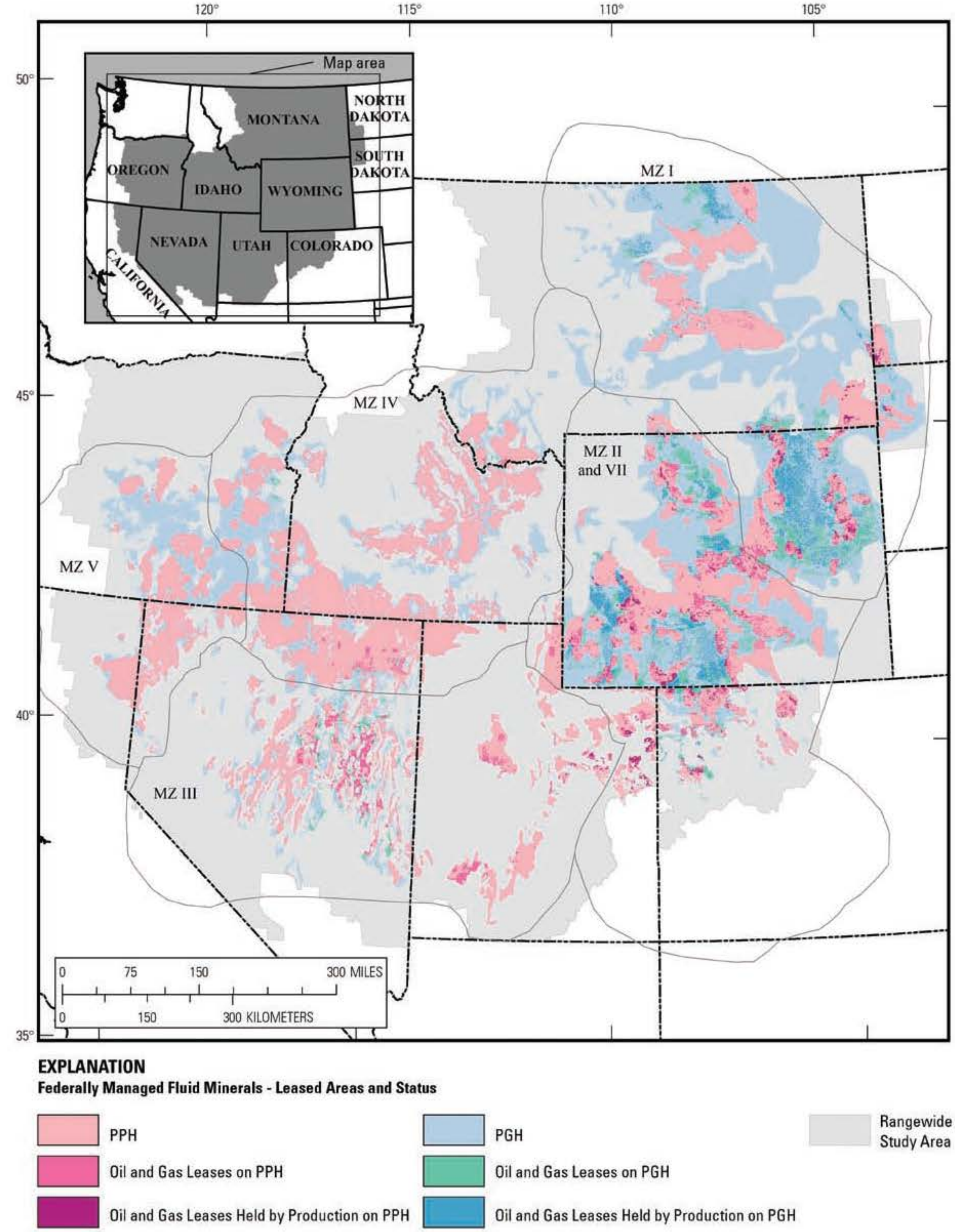

Figure 16*A*. Overlap of Federally managed, subsurface acres (held by production and developed leases) and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

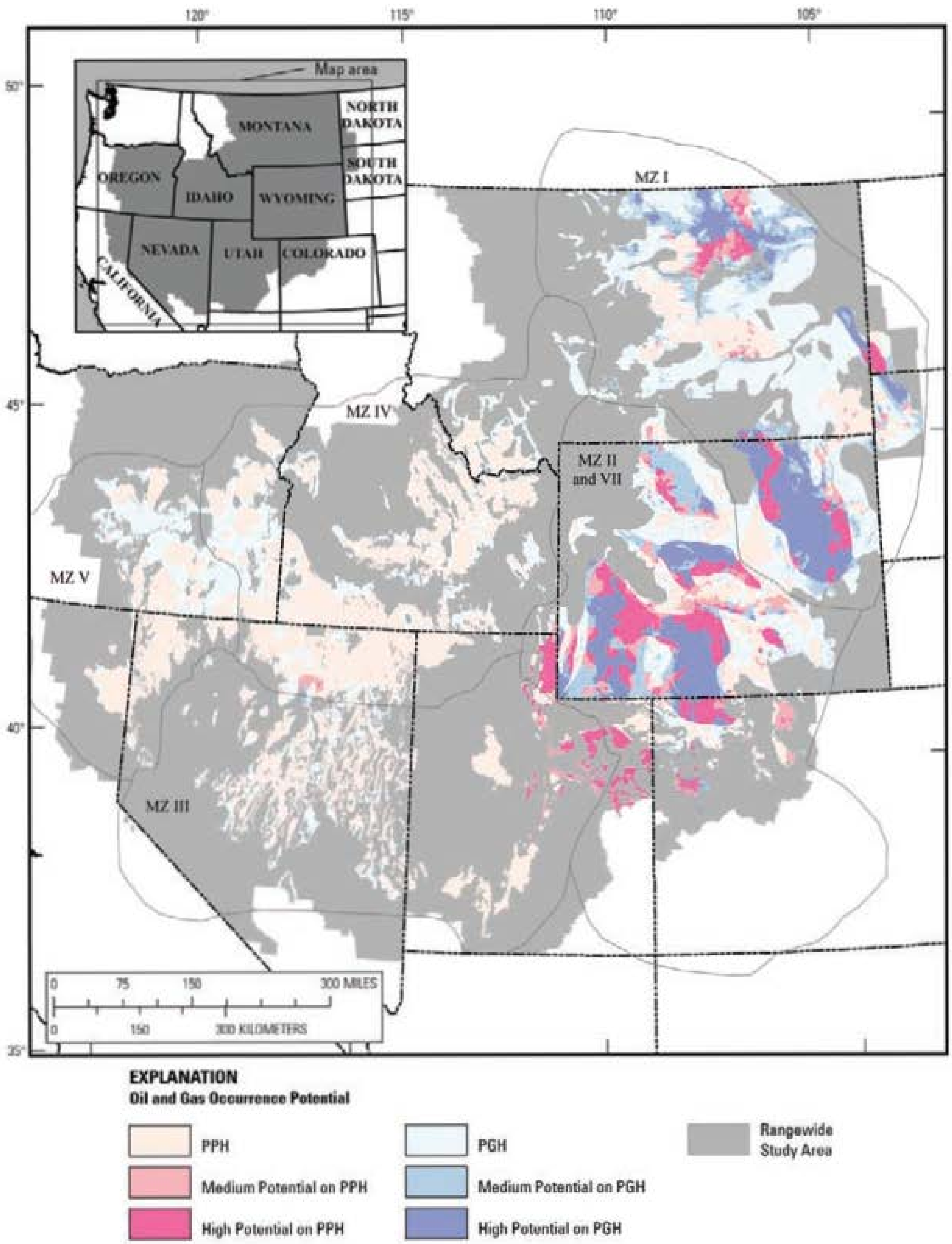

Figure 16*B*. Overlap of oil and gas resource occurrence potential and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

on lek attendance—of 3 to 4 years between the time infrastructure is placed and lek abandonment has been consistently documented (Naugle and others, 2011) making short-term observations potentially misleading. Time lags in response to infrastructure have been documented as short as 2 years, or as long as 10 years (Harju and others, 2010).

In general, the research suggests that sage-grouse are negatively affected when well-pad densities within approximately 3.2 km (2 mi) of a lek exceed 1 pad/section and when leks become surrounded by infrastructure. Energy development as far as 6.4 km (4 mi) to a lek may negatively influence lek attendance. Anthropogenic noise is a component of energy developments causing declines in male lek attendance; however, all potential causes of declines resulting from energy developments have not been examined empirically. Negative effects of energy development to sage-grouse may occur at distances approaching 18 km (11 mi), and the ultimate effects of infrastructure may not become apparent for up to 10 years following the addition of infrastructure to the landscape.

Sage-grouse population declines resulted from avoidance of infrastructure during one or more seasons, reduced productivity, and (or) reduced survival (Naugle and others, 2011). A meta-analysis of grouse populations in general (including sage-grouse, prairie chickens, sharp-tailed grouse, and black grouse) suggested moderate to large displacement effects and small to moderate demographic effects of the infrastructure of energy developments; the displacement effect varied by feature type with power lines and roads having the largest effects (Hagen, 2010). Yearling female sage-grouse avoided nesting within 950 m (0.5 mi) of the infrastructure of natural gas fields (Holloran and others, 2010), and visible wells within a 1 km^2 (247 acres) area negatively influenced female selection of nesting habitats (Kirol, 2012). Female early brood-rearing (early June to early July) locations were negatively correlated with the number of visible wells within a 1 km^2 area, and late brood-rearing females (early July through late August) avoided habitats when a surface disturbance (well pads and improved roads, for example) threshold of approximately 8 percent of a 5 km^2 (1,200 acres) area was surpassed (Kirol, 2012). Sage-grouse were 1.3 times more likely to occupy winter habitats within a 4 km^2 (990 acre) area that had not been fully developed for energy (eight pads/section) and avoided habitats within 1.9 km (1.2 mi) of infrastructure during winter (Naugle and others, 2011).

Decline in sage-grouse population growth (21 percent) between pre- and post-development was primarily attributed to decreased nest success and adult female annual survival; treatment effect (proximity to gas field infrastructure) was especially noticeable on annual survival of nesting adult females (Holloran and others, 2005). Annual survival of individuals reared near gas field infrastructure (yearling females and males) was significantly lower than control individuals that were not reared near infrastructure (Holloran and others, 2010). The probability that males reared near gas fields established a breeding territory was half that of control males (Holloran and others, 2010). Fewer females from impacted leks (that is, leks within 3 km [1.9 mi] of gas field infrastructure) initiated nests compared to females from non-impacted leks (Lyon and Anderson, 2003). The closer a nest was to a natural gas well (that existed or was installed in the previous year), the more likely it was to fail (Dzialak and others, 2011). When a surface disturbance (such as well pads and improved roads) threshold of approximately 4 percent of a 1 km^2 (247 acre) area was surpassed, risk of daily brood loss increased, and risk of chick mortality was 1.5 times greater for each additional well site visible within 1 km (0.6 mi) of brood locations (Naugle and others, 2011; Kirol, 2012).

Only one study has empirically examined the response of sage-grouse to explicit changes in conventional natural gas development protocols. In southwestern Wyoming, differences in reactions of wintering sage-grouse to conventional well pads (liquid by-products stored and collected on-site) and well pads equipped with liquid gathering systems (liquid by-products piped off-site eliminating the need for tanker trucks to visit the pad) with reduced daily traffic volumes to individual pads from eight to three vehicles/day on average were examined (Holloran and others, in press). Sage-grouse avoided suitable winter habitats with high well-pad densities regardless of differences in activity levels associated with well pads. However, there was consistent suggestion across analyses that the distance-effect on sage-grouse of well pads equipped with liquid gathering systems may be less than that of conventional well pads. There was a strong positive relation between distance to drilling rig and average hours spent in an area.

In general, females selecting habitats near infrastructure have demonstrated lower annual survival (resulting in population-level declines in response to development), and females influenced by development activity within 3 km (1.8 mi) of the lek are less likely to initiate a nest. Nesting females avoid areas within approximately 1 km (0.6 mi) of infrastructure, and nests closer to infrastructure are at a higher risk of nest failure. Brood-rearing females avoid areas within approximately 0.5 km (0.3 mi) of infrastructure, broods reared within 1 km of infrastructure are less likely to be successful, and yearling male and female survival and yearling male fecundity (the probability of establishing a breeding territory) are lower for individuals reared near infrastructure. It is worth noting that a meta-analysis of sage-grouse demographic rates collected rangewide during a 73-year period suggested that female survival, chick survival, and nest success were demographics that had the greatest influence on sage-grouse population growth (Taylor and others, 2012). Sage-grouse during the winter avoid habitats with high well-pad densities and avoid areas within 1.9 km (1.2 mi) of a well pad; reduced anthropogenic activity levels at well pads may reduce the range of indirect (nonmortality effects) effects on sage-grouse on winter habitats (for example, reduction of avoidance).

Wind Energy Developments

Federal lands in the Western United States have significant potential to produce energy from wind power (Connelly and others, 2004). Few wind turbines currently exist within the range of sage-grouse, which makes assessment of this threat challenging; approximately 1,800 acres (0.001 percent) of sage-grouse habitat are directly influenced by wind turbines throughout the range of the species (table 14, fig. 17). Indirect effects to sage-grouse from wind energy developments were also assessed using the spatial foraging behaviors of avian predators that have an estimated range of 4.3 mi (6.9 km) from perching locations. This estimate suggests that current wind energy developments influence approximately 0.31 percent of priority habitats throughout the species' range. Private lands account for most (approximately 72 percent) of the priority habitats indirectly influenced by wind turbines; BLM lands account for approximately 21 percent of these habitats indirectly influenced by turbines. Though largely unspecified (most Federal lands are not currently leased or developed), the coincidence of wind potential (for energy production) and sage-grouse habitats, including PPH and PGH, is high across sage-grouse range, and is especially widespread in MZs I and II (fig. 18*A*). Estimating development potential also includes location and proximity of transmission infrastructure and markets as well as market trends (energy prices); therefore, wind potential is only one of several indications of potential and all are not considered here. However, current development is greatest where rights of way leases have been issued, suggesting wind energy development potential in the near future will increase if in close proximity to available transmission. Thus areas with suboptimal wind speeds may be developed before those with better resources if near available transmission. For example, although wind potential for energy production is not high in MZ IV, significant wind energy transmission Rights of Way overlap PPH in MZ IV suggesting habitats in this MZ may be developed (fig. 18*B*). Concerns surrounding wind energy development and sage-grouse include noise produced by the rotor blades, sage-grouse avoidance of structure, and mortality to sage-grouse flying into rotors; however, the greater influence on sagebrush ecosystems will likely result from the roads and power lines that are necessary to construct and maintain sites used for wind energy (Connelly and others, 2004). These effects are discussed at length in the previous section (also see Section III. A4. Infrastructure). The only study on specific effects of wind development on sage-grouse was recently completed in south-central Wyoming (LeBeau, 2012). The relative probabilities of a sage-grouse nest and brood failing (all chicks lost between hatch and 35-days post-hatch) increased with proximity to nearest wind turbine. Notably, this study investigated the short-term response of sage-grouse to a wind energy facility; the impacts of a facility may not be realized within 2 to 4 years of the addition of wind turbines due to the time lags associated with responses of sage-grouse breeding populations to infrastructure.

In Situ Uranium

According to the World Nuclear Association (London, United Kingdom; *www.world-nuclear.org*), in situ recovery (ISR) of uranium in North America involves recovering the minerals from an ore body by injecting solution to dissolve the uranium, pumping the pregnant solution to the surface, and removing the uranium from solution at a processing plant. Several projects are currently licensed to operate in the United States including several producing and proposed mines in Wyoming; most of the operating mines date from the 1990s. Uranium deposits are found predominantly in southeastern portions of MZ I (Powder River Basin), throughout MZ II, and in eastern MZ III and western MZ VII (Finch, 1996). The design of ISR-well fields varies depending on local conditions such as permeability, sand thickness, deposit type, ore grade, and ore distribution. However, whatever the well-field design used, there is a mixture of injection wells (to introduce the leach solution to the ore body) and extraction wells with submersible pumps used to deliver pregnant solution via pipeline to the processing plant. Wells with a common purpose (injection or extraction) are generally spaced 65 to 200 ft (20 to 60 m) apart. Wells are typically the same size as water-well bores, and the processing plant is generally situated on-site creating basic infrastructure of wells, pipelines, and a processing plant within a geologically defined area.

The largest environmental risk with an ISR uranium facility is the potential impacts to groundwater resulting from (1) residual constituent concentrations in excess of baseline concentrations after the restoration of the production aquifer, (2) a migration of production liquids from the production aquifer to the surrounding aquifers during operation, (3) a mechanical failure of the subsurface-well materials releasing production fluids into the overlying aquifers, (4) movement of constituents to groundwater outside the licensed area, and (5) excessive consumption of groundwater (School of Energy Resources, University of Wyoming, Laramie, Wyo.; *www.uwyo.edu/ser/*). A detailed description of surface disturbance associated with an in situ uranium mine could not be found; however, based on pictures provided by Ur-Energy (Littleton, Colo.), a company developing in situ uranium mines in Wyoming, surface disturbance most closely aligns with that found in a coal bed natural gas field at a localized scale (for example, wells not distributed across a large landscape but focused on discrete ore deposits) without overhead utilities and substantial water discharge. Beyond potential impacts of water contamination, potential disturbance to sage-grouse could occur during drilling phases of development, from the processing plant, and from traffic on roads accessing well fields (an intensively developed region) and the processing plant. Minimal surface disturbance appears to occur within the well field.

Oil Shale and Tar Sands

Oil shale (also referred to as tar sands) is fine-grained sedimentary rock that contains relatively large amounts of kerogen, which can be converted into liquid and gaseous hydrocarbons (petroleum liquids, natural gas liquids, and methane) by heating the rock. According to the U.S. Energy Information Administration (*www.eia.gov*), the richest U.S.

Table 14. Summary of the direct and indirect influences of wind turbines* across Management Zones (MZ) by acres of preliminary priority and preliminary general sage-grouse habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

	PPH					PGH				
Management Zone Entity	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Innfluence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**100**	**122,100**	**0.00**	**1.05**	**34,663,000**	**800**	**243,600**	**0.00**	**0.70**
BLM	2,994,300	0	25,800	0.00	21	4,524,900	0	14,900	0.00	6
Forest Service	292,400	0	100	0.00	0	515,300	0	0	0.00	0
Tribal and Other Federal	219,700	0	0	0.00	0	2,427,700	0	0	0.00	0
Private	7,132,500	100	88,100	0.00	72	24,682,800	700	211,100	0.00	87
State	995,600	0	8,100	0.00	7	2,498,400	0	17,600	0.00	7
Other	1,900	0	0	0.00	0	13,900	0	0	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**0**	**75,900**	**0.00**	**0.43**	**19,200,200**	**700**	**306,700**	**0.00**	**1.60**
BLM	9,021,200	0	16,500	0.00	22	9,012,500	0	65,700	0.00	21
Forest Service	162,000	0	0	0.00	0	452,500	0	0	0.00	0
Tribal and Other Federal	784,000	0	0	0.00	0	1,354,600	0	0	0.00	0
Private	6,233,900	0	52,900	0.00	70	7,394,800	600	223,000	0.01	73
State	1,244,800	0	6,600	0.00	9	979,800	100	18,000	0.01	6
Other	30,100	0	0	0.00	0	6,000	0	0	0.00	0
MZ III–SGB	**10,028,500**	**0**	**0**	**0.00**	**0.00**	**3,970,100**	**0**	**0**	**0.00**	**0.00**
MZ IV–SRP	**21,930,600**	**0**	**11,500**	**0.00**	**0.05**	**10,958,500**	**200**	**93,800**	**0.00**	**0.86**
BLM	13,710,700	0	2,000	0.00	17	4,928,200	0	29,900	0.00	32
Forest Service	1,613,800	0	0	0.00	0	1,113,500	0	0	0.00	0
Tribal and Other Federal	633,600	0	0	0.00	0	522,500	0	2,900	0.00	3
Private	4,890,200	0	9,400	0.00	82	3,516,742	200	57,900	0.01	62
State	1,019,373	0	100	0.00	1	846,200	0	3,100	0.00	3
Other	62,900	0	0	0.00	0	31,400	0	0	0.00	0

Table 14. Summary of the direct and indirect influences of wind turbines* across Management Zones (MZ) by acres of preliminary priority and preliminary general sage-grouse habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH					PGH				
	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Innfluence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	6.9 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**0**	**0**	**0.00**	**0.00**	**5,808,000**	**0**	**0**	**0.00**	**0.00**

*Data Source: Federal Aviation Administration Digital Obstacles File, 2011

[1]Direct footprint is the co-location of existing wind turbines within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from foraging distances of predators (Boarman and Heinrich, 1999; Leu and others, 2008).

[2]For MZ calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within a management zone calculated as the percent of the total indirect impact in the management zone represented by that management entity; that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

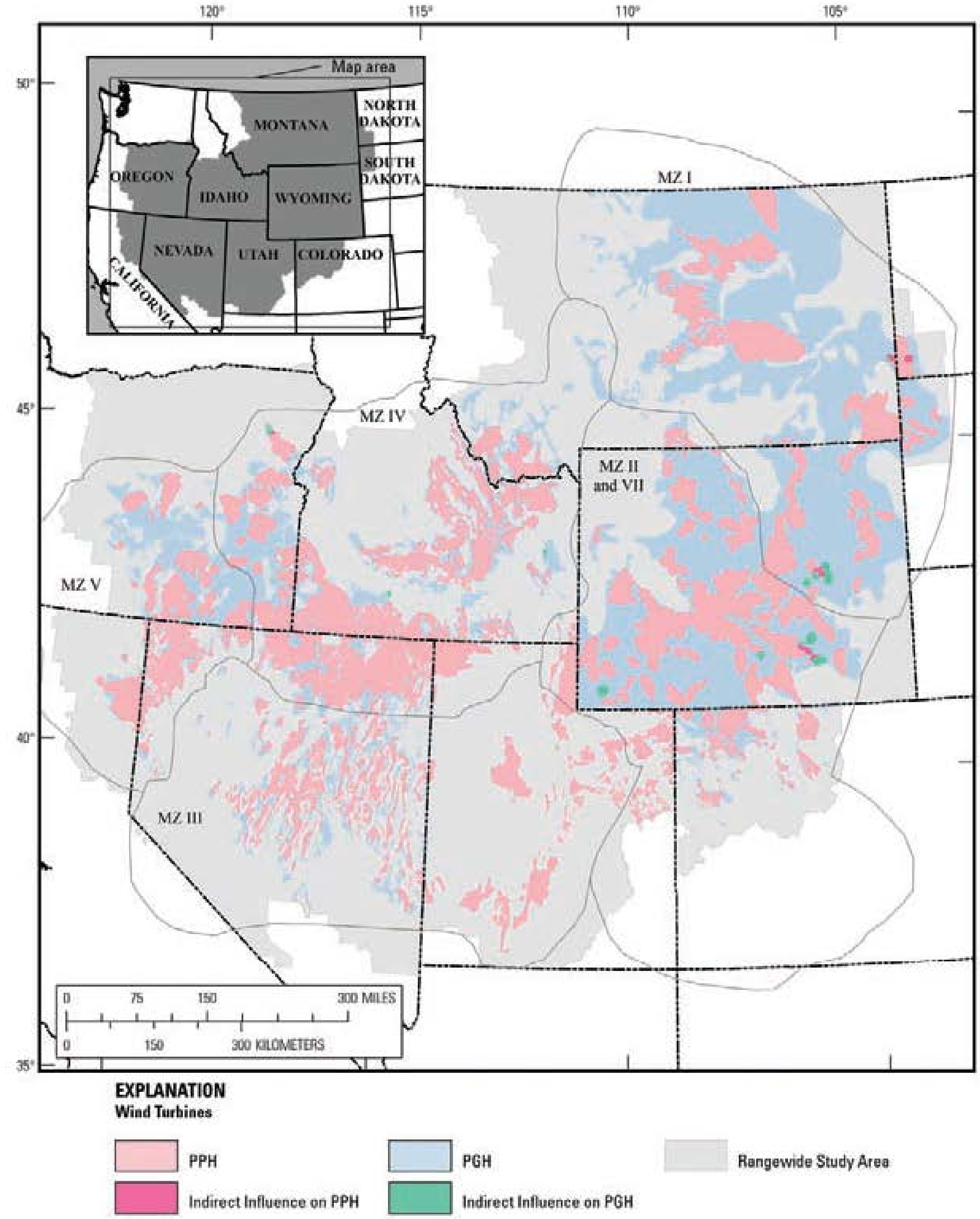

Figure 17. Overlap of wind turbines, potential indirect influences of wind turbines, and preliminary priority and preliminary general habitats (PPH and PGH, respectively) across Management Zones (MZ).

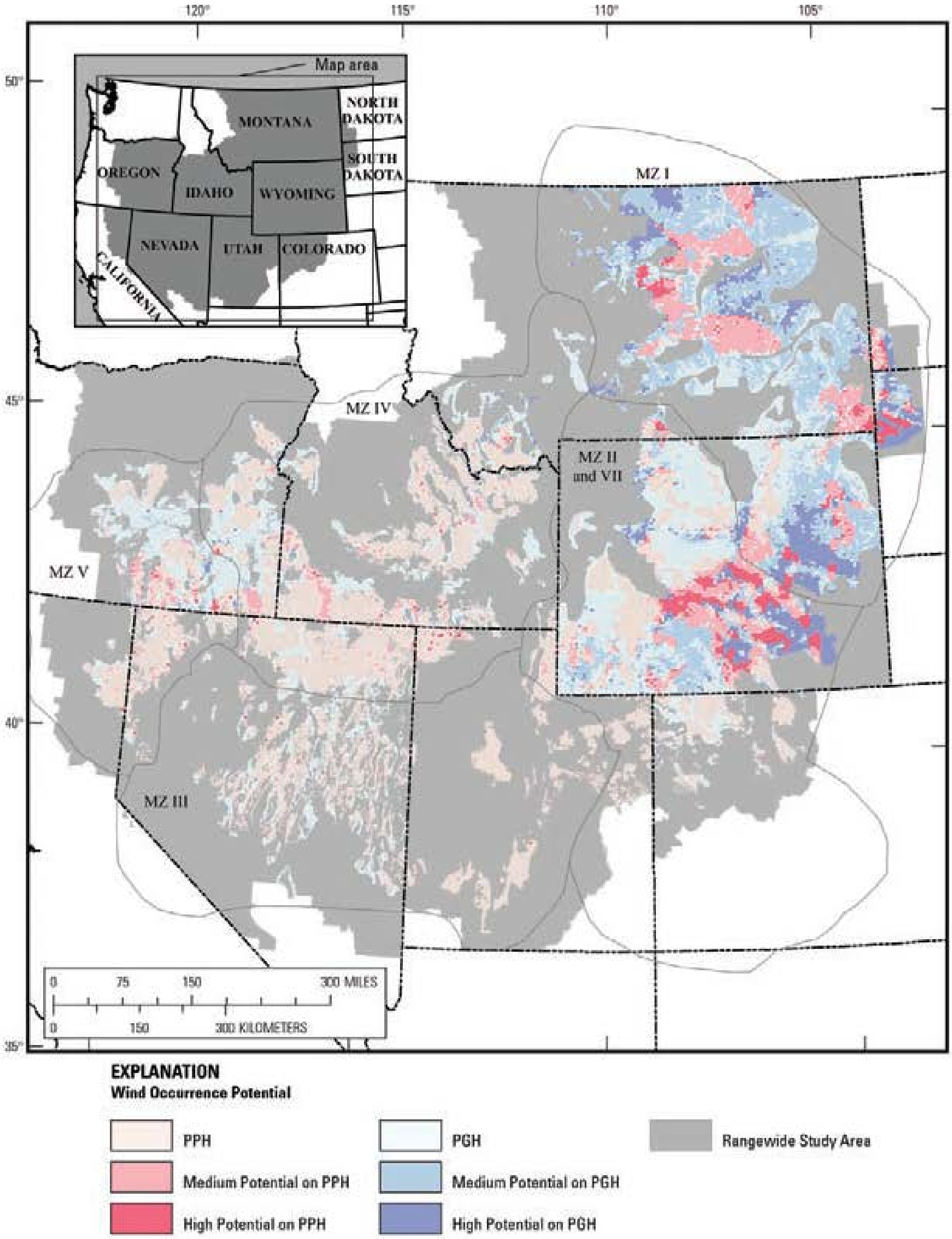

Figure 18*A*. Distribution of wind occurrence potential (based on mean wind speeds) within preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

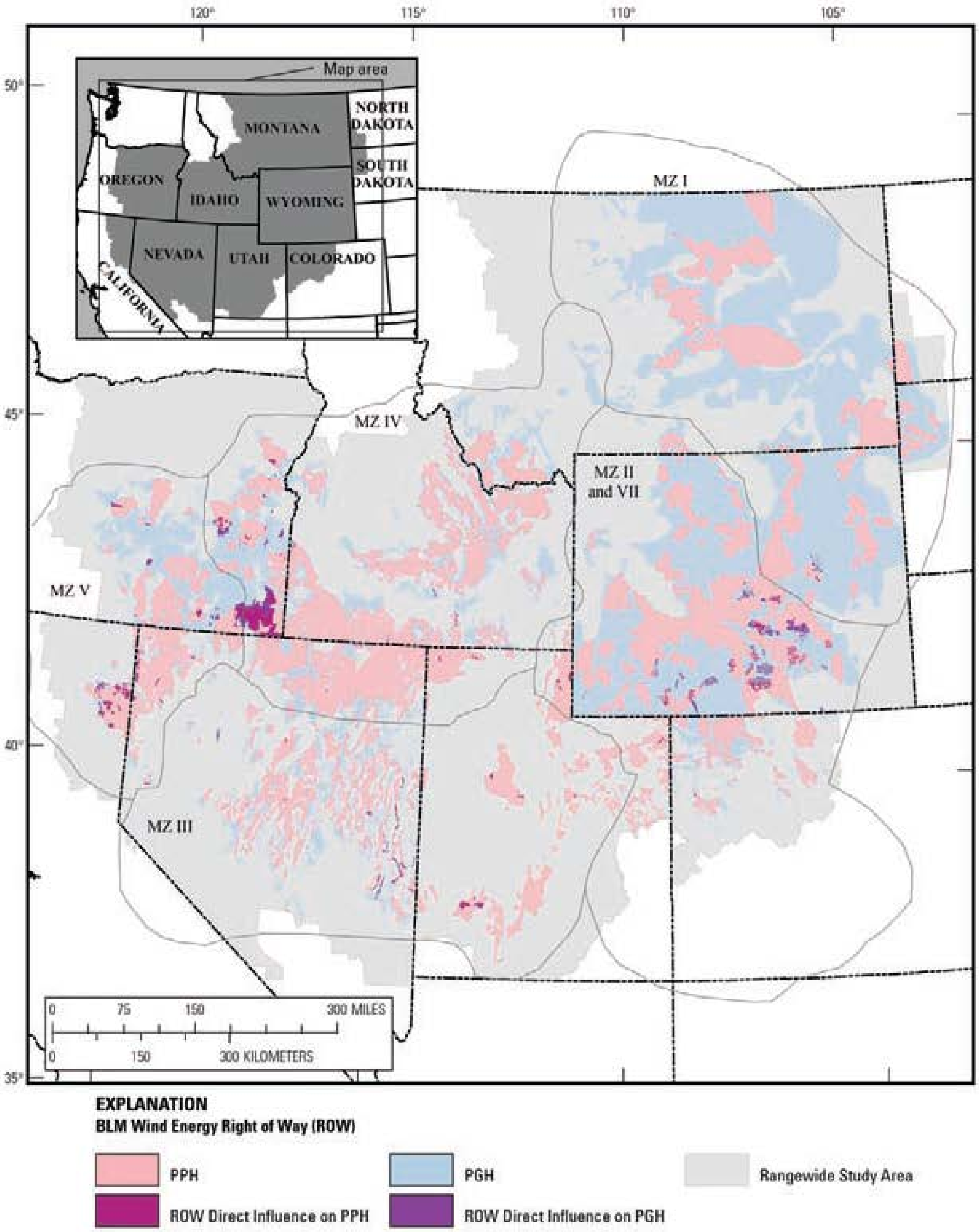

Figure 18*B*. Overlap of Federal wind energy right-of-way leases with preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

oil shale deposits are located in northwest Colorado, northeast Utah, and southwest Wyoming, and deposits in these regions are currently the focus of petroleum industry research and potential future production. Current Federal leases for oil shale resources within sage-grouse range are limited to 331 km^2 (81,800 acres) within MZs II and VII (fig. 19*A*); a majority of these developments are on BLM managed lands (surface) with the remaining portion split between private and State lands. Development potential extends beyond the current footprint with the richest deposits in northwest Colorado overlapping sage-grouse populations in MZ VII (fig. 19*B*) and has been subjected to a programmatic analysis considering resource potential, technology, and resource management issues (BLM, 2012b). Given support of technology and market forces, these fields may ultimately produce more than 1 million barrels of oil equivalent per one acre (2.6 km^2; deposits in Alberta are expected to produce about 100,000 barrels per acre [2.6 km^2]) suggesting that this may be an important factor in sage-grouse habitat conservation in the future.

Techniques for extracting resources from oil shale can be generally categorized as direct or indirect recovery: (1) direct recovery involves the removal of the oil shale from its formation for ex situ processing and (2) indirect or in situ recovery involves some degree of processing of the oil shale while it is still in its natural depositional setting, leading ultimately to the extraction of just the desired organic fraction. The key steps in processing are retorting and pyrolysis. Retorting is a process that causes thermal decomposition of the organic fraction of the oil shale (kerogen); the recovered organic fraction is then distilled, or pyrolyzed, to produce three products: crude shale oil, flammable gases (including hydrogen, methane, and natural gas), and char (deposited on spent shale). Surface mining techniques (strip mining and or pit mining) as well as subsurface mining techniques (room-and-pillar mining, longwall mining, and other derivatives) have been successfully employed in the recovery of oil shale; however, the BLM considers the potential of surface mining in the future low. Indirect recovery techniques generally cause decomposition of kerogen to liquid and gaseous organic fractions that have sufficient mobility to "flow" through the formation for removal by conventional oil and gas recovery techniques. Surface disturbance most closely aligns with that found in a natural gas field, although well densities may be higher due to the requirement of injection (heat) and recovery wells in relative close proximity. Therefore, sage-grouse will likely respond to in situ oil shale development similarly to conventional natural gas development.

In situ recovery processes currently being researched are regarded by the U.S. Department of Energy as a promising technology. Although the technical feasibility of in situ retorting has been proven, considerable technological development and testing are needed before any commitment can be made to a large-scale commercial project. Confirmation of the technical feasibility of the processes hinges on the resolution of two major technical issues: controlling groundwater during production and preventing subsurface environmental problems, including groundwater impacts. Of special concern in the arid Western United States is the large amount of water required for oil shale processing; currently, oil shale extraction and processing require several barrels of water for each barrel of oil produced. The Energy Information Administration estimates that the earliest date for initiating construction of a commercial in situ oil shale project is 2017 with the first commercial production occurring probably no sooner than 2023. The information presented in this paragraph as well as a detailed discussion of the technology required for the recovery (that is, mining), processing (that is, retorting and pyrolysis of the hydrocarbon fraction), and upgrading of oil shale resources can be found in the Draft Programmatic Environmental Impact Statement and Possible Land Use Plan Amendments for Allocation of Oil Shale and Tar Sands Resources on Lands Administered by the Bureau of Land Management in Colorado, Utah, and Wyoming (BLM, 2012b).

Solar

Solar power generation facilities that are likely to be developed for utility-scale capture of solar energy (that is, ≥20 MW [megawatts] electricity that will be delivered into the electricity transmission grid) in the United States during the next 20 years include concentrating solar power—which includes parabolic trough, power tower, and dish engine systems—and photovoltaic arrays. The main component that all these technologies have in common is a large solar field where solar collectors capture the sun's energy. In the parabolic trough and power tower systems, the energy is concentrated in a heat transfer fluid and transferred to a power block where steam-powered turbine systems generate electricity using similar technology to that used in fossil-fuel-fired power plants. In contrast, the dish engine and photovoltaic systems are composed of many individual units or modules that generate electricity directly and whose output is combined; these systems do not use a central power block. Solar facilities are likely to have an operational lifetime of 30 years or more, representing long-term effects on habitats where they co-occur. Although no current facilities affect sage-grouse range measurably (the USFWS listing decision identified small developments in Wyoming and California), the southern portion of sage-grouse range includes higher yields per unit area of solar potential indicating that, given technological developments, transmission infrastructure, and market forces, many of these lands could be targeted for solar energy facilities in the future (fig. 20; BLM, 2012c).

The primary environmental concerns associated with solar power generation include the large land area required for solar facilities and water consumption. Concentrating solar power systems generally require 5–10 acres (2 ha–4 ha) to produce 1 MW, and photovoltaic systems require around 10 acres (4 ha) per MW. Additional impacts will include access roads and transmission lines. Although solar developments themselves are not similar to the infrastructure of energy developments discussed above, impacts to sage-grouse from

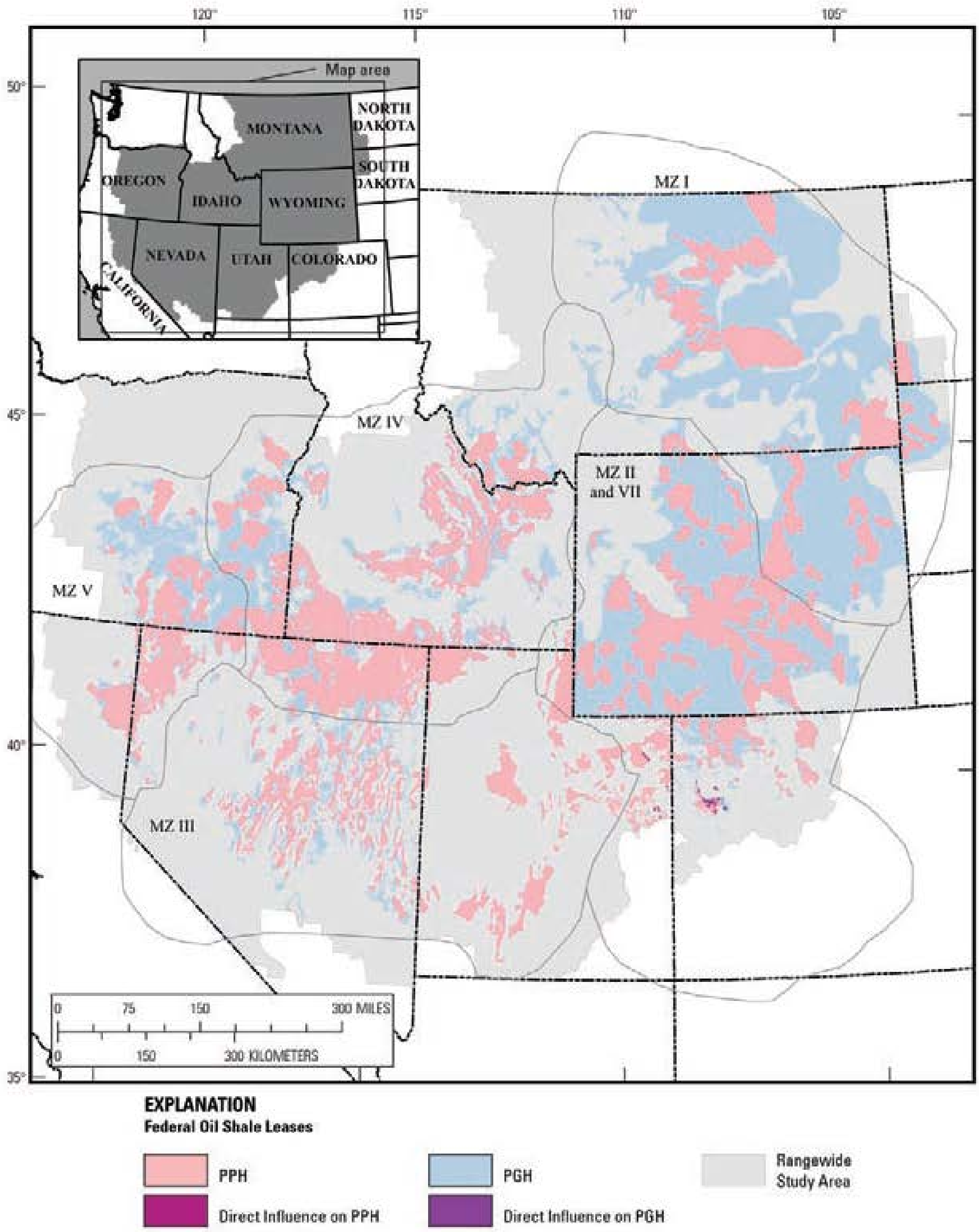

Figure 19*A*. Overlap of Federal oil shale leases and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH). MZ, Management Zone.

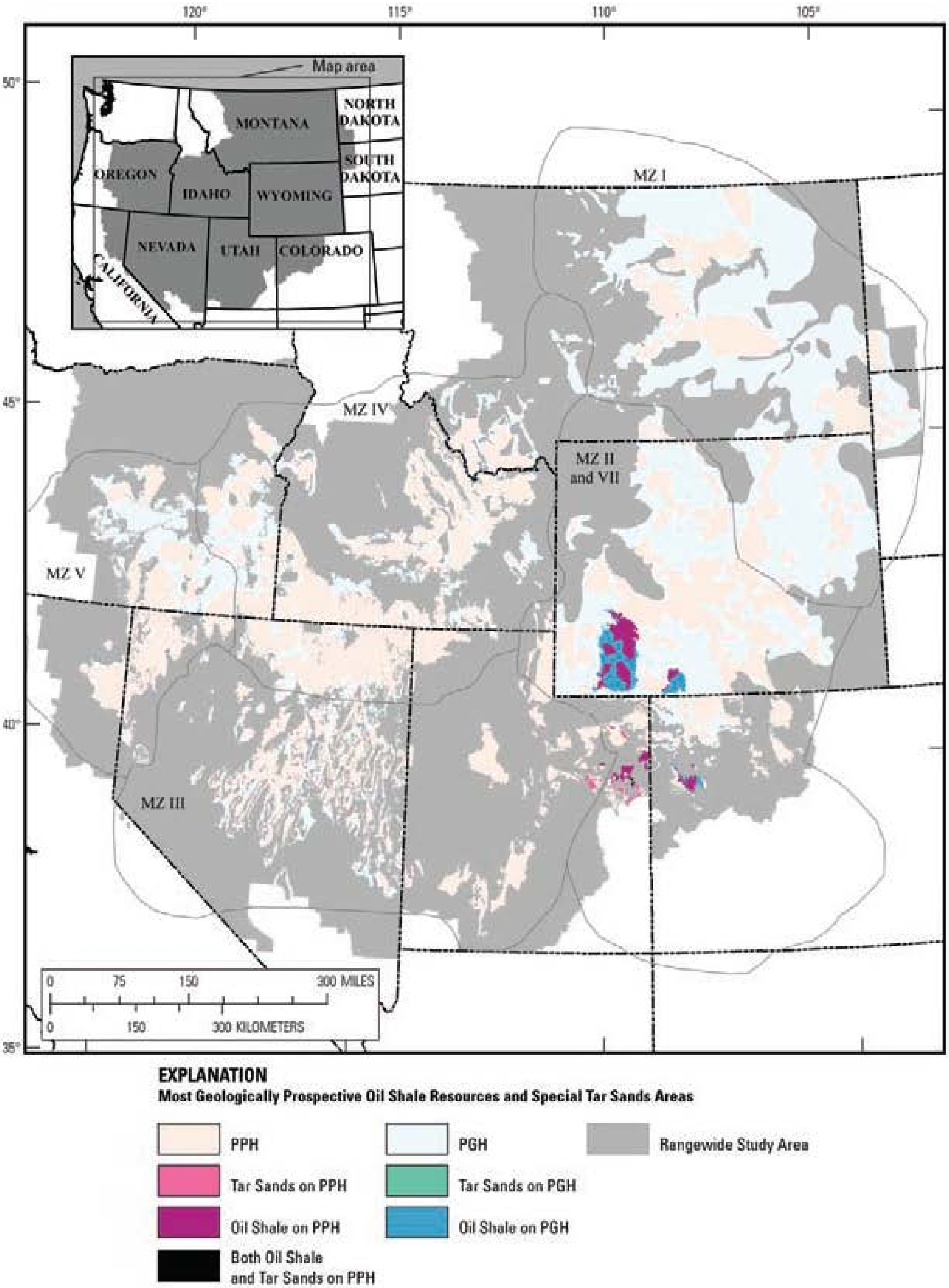

Figure 19*B*. Overlap of the most likely geological prospects for oil shale and tar sands development and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

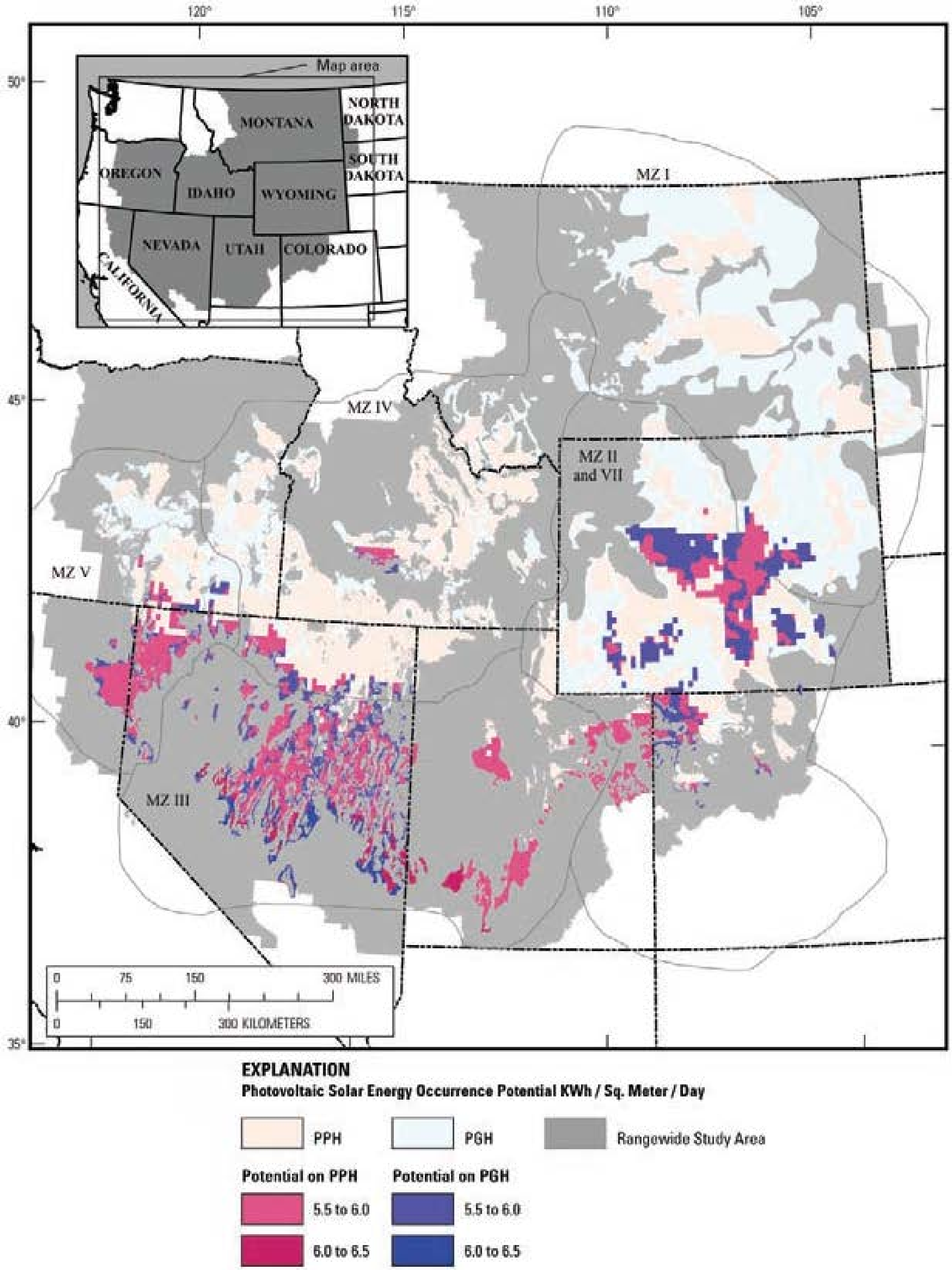

Figure 20. Overlap of photovoltaic-based estimates of solar power potential and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone; KWh/M^2/day, kilowatt hours per square meter per day.

direct habitat loss, habitat fragmentation via roads and transmission lines, noise, and increased human presence (Connelly and others, 2004) may be similar to those discussed for nonrenewable energy development. The information presented in this section as well as a detailed discussion of the technology required for generation of solar-based electricity can be found in the Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States (BLM, 2012c).

Geothermal

According to the Geothermal Energy Association (see Web site at geo-energy.org), geothermal energy is defined as heat from the Earth; heat continuously flowing from the Earth's interior is estimated to be equivalent to 42 MW of power. Geothermal energy production within the range of sage-grouse is primarily within the Southern and Northern Great Basins MZs. As of 2011, approximately 2,000 km^2 (494,200 acres) of sagebrush habitat has been leased for this purpose and an additional 1,140 km^2 (281,700 acres) are pending (Knick and others, 2011). The only type of geothermal energy that has been widely developed, currently, is hydrothermal energy, which consists of trapped hot water or steam, however technologies are evolving such that these developments may become an important consideration in the near future.

Impacts to sage-grouse associated with geothermal energy development have not been assessed because the development has been too recent to identify any immediate or lag effects (Knick and others, 2011), but geothermal power plants are similar to fossil-fuel-fired power plants in that resources are exploited in a highly centralized fashion, thus surface impacts could include the footprint of the power plant itself, access roads, and transmission lines. Extraction of geothermal fluids (gases, steam, and water) for power generation generally requires many of the same infrastructure features for construction and operation as do traditional nonrenewable energy resources. As such, impacts of geothermal developments to sage-grouse from direct habitat loss, habitat fragmentation via roads and transmission lines, noise, and increased human presence (Connelly and others, 2004) may be similar to those discussed for nonrenewable energy development with comparable effects on local sage-grouse populations also anticipated.

Although geothermal development occurs throughout MZs III, IV, and V, the direct footprint is relatively small with approximately 141,800 acres (0.38 percent) of sage-grouse habitat directly impacted by geothermal leases in these MZs (table 15, fig. 21*A*). Geothermal developments are widespread in priority habitats in western portions of MZ III in particular. No geothermal development currently occurs in MZs I and II. However, geothermal development potential is distributed across a majority of priority and general habitats throughout the range of sage-grouse (fig. 21*B*).

Air and water pollution, disposal of hazardous waste, siting, and land subsidence are environmental concerns related to geothermal electricity generation; however, many of the air and water concerns are eliminated in closed-loop systems. In addition to these impacts, geothermal energy extraction may cause the release of toxic gases (carbon dioxide and hydrogen sulfide) and elements (arsenic) into the environment. The form, and subsequent effects, of these substances depends on the geological formation from which energy is being extracted. Large quantities of water may also be required for drilling and condenser cooling (Suter Ii, 1978), and if the water used for these purposes depletes the water resources of the surrounding habitat, riparian and brood-rearing habitats may be affected by water-table changes. On-site water storage may increase potential WNv (West Nile virus) exposure in the area (Friend, 2001; Zou and others, 2006; Walker and others, 2007a; Walker and Naugle, 2011).

Hydrothermal energy, based on trapped water or steam, is the only type of geothermal energy that has been widely developed at this time. However, new technologies are being developed to exploit hot dry rock (accessed by drilling deep into rock), geopressured resources (pressurized brine mixed with methane), and magma (see Union of Concerned Scientists Web site at *www.ucsusa.org*) making these developments potentially important considerations for the near future and making direct and indirect effects on sage-grouse anticipated and logical, but speculative.

Mining

Besides oil and natural gas development, the major mining activity within sage-grouse habitats has been for coal (Braun, 1998). However, mining for other substances—especially bentonite, trona, and gravel—occurs throughout the range of the species, and mining and exploration for rare minerals (such as, gold, silver, and copper) has recently become more common and may influence sage-grouse habitats extensively in some regions. Coal mines are widespread, but discretely located in sage-grouse habitats MZ I and southern portions of MZs II and VII, and Federal leases developed through surface extraction directly influence approximately 22,100 acres (89 km^2; <0.1 percent) of these MZs (table 16, fig. 22). There is potential for additional coal mining in large portions of priority and general habitats in MZs I, II, and VII (fig. 23). Indirect effects of surface coal mines with Federal leases were estimated using a 19-km (11.8-mi) effects buffer based on observations of industrial infrastructure effects on sage-grouse, which suggests influence over approximately 8 percent of priority sage-grouse habitats across the range of the species and approximately 5 percent of priority habitats in MZs I, II, and VII. Approximately 36 percent of priority habitats that are indirectly influenced by coal mines across the species' range are managed by BLM. Surface mining accounts for about 67 percent of production in the United States; large opencast mines can cover an area of many square kilometers. Coal mining and the use of coal to produce electricity raises a number of environmental challenges including soil erosion, dust, noise, water pollution, acid-mine drainage, and

Table 15. Summary of geothermal leases* across Management Zones (MZ) by acres of sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH			PGH		
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)
MZ I–GP	11,636,400	0	0.00	34,663,000	0	0.00
MZ II and VII–WB & CP	17,476,000	0	0.00	19,200,200	0	0.00
MZ III–SGB	10,028,500	72,900	0.73	3,970,100	52,700	1.33
MZ IV–SRP	21,930,600	58,000	0.26	10,958,500	17,900	0.16
MZ V–NGB	7,097,200	10,900	0.15	5,808,000	31,800	0.55

*Data Source: Aggregated from individual BLM State Office Submissions in 2011 and 2012.

air emissions in addition to impacts on local species. Burning coal releases oxides (especially of sulfur [SO_x] and nitrogen [NO_x]), trace elements (mercury, for example), and particulate matter into the atmosphere with potential effects on local, and global, habitat conditions.

Other forms of mining (for example, bentonite, gravel, potash, and trona) can also influence sage-grouse habitats. The magnitude of the impacts of mining activities on sage-grouse and sagebrush habitats is largely unknown (Braun, 1998), but mining of various Federal mineral resources (locatable and saleable) currently affects approximately 3.6 percent of potential sage-grouse habitat directly (across all MZs) with indirect effects potentially affecting large portions (5–32 percent) of some MZs (table 17*A*). In addition, existing leases for development of non-energy, leasable minerals represent a relatively small threat (spatially) but may ultimately be developed to their full, spatial extent based on existing agreements (table 17*B*).

Development of surface mines and associated infrastructure (such as, roads and power lines), noise, and human activity may negatively impact sage-grouse numbers in the short term (Braun, 1998), and a variety of mineral claims could result in industrial activities that would disrupt the habitat and life-cycle of sage-grouse (fig. 24). The number of displaying sage-grouse on 2 leks within 2 km (1.25 mi) of active mines in northern Colorado declined by approximately 94 percent during a 5-year period following an increase in mining activity (Remington and Braun, 1991). However, Braun (1998) reported recovery of populations in Montana, Wyoming, and Colorado may occur after initial development and subsequent reclamation of mine sites, although populations do not recover to pre-development sizes. Additionally, population re-establishment may take as long as 30 years (Braun, 1998).

A6. Fire

Although large fires play an important role in landscape ecology for most of the Western United States, fire is much less important in the function of sagebrush-bunchgrass ecosystems than most forested systems (Keane and others, 2008). Given the suite of contributing disturbances, fire currently has largely negative effects on sage-grouse by directly affecting the distribution and condition of available sagebrush habitats (Nelle and others, 2000; Beck and others, 2009; Rhodes and others, 2010; Baker, 2011). Sage-grouse require the cover and forage provided by mature sagebrush and healthy herbaceous communities, and habitat selection research indicates strong selection at multiple scales and increased nesting success in areas with greater cover (Sveum and others, 1998a; Connelly and others, 2000c; Holloran and others, 2005; Aldridge and Boyce, 2007; Hagen and others, 2007; Yost and others, 2008; Kolada and others, 2009; Atamian and others, 2010; Carpenter and others, 2010; Doherty and others, 2010b; Bruce and others, 2011; Doherty and others, 2011a; Hagen and others, 2011; Aldridge and others, 2012; Kirol and others, 2012; Tack and others, 2012). Wildfire and prescribed fires typically kill sagebrush thereby reducing cover and forage in the short term. However, fire is also associated with natural dynamics and spatial heterogeneity of many sagebrush ecosystems, suggesting that not all fires (wildfire or prescribed) in sagebrush communities have net-negative effects on sage-grouse populations and habitats. On the contrary, whereas vegetation and fuel management will likely preclude use of fire in some areas (for example, winter habitats or Wyoming big sagebrush habitats), the need to reduce tree cover (especially juniper) and fuel continuity (in mountain sagebrush communities of MZs II, IV, and V, for example) means that prescribed fire may be an important management option in other areas. If landscape-scale habitat patterns stabilize and local populations are not

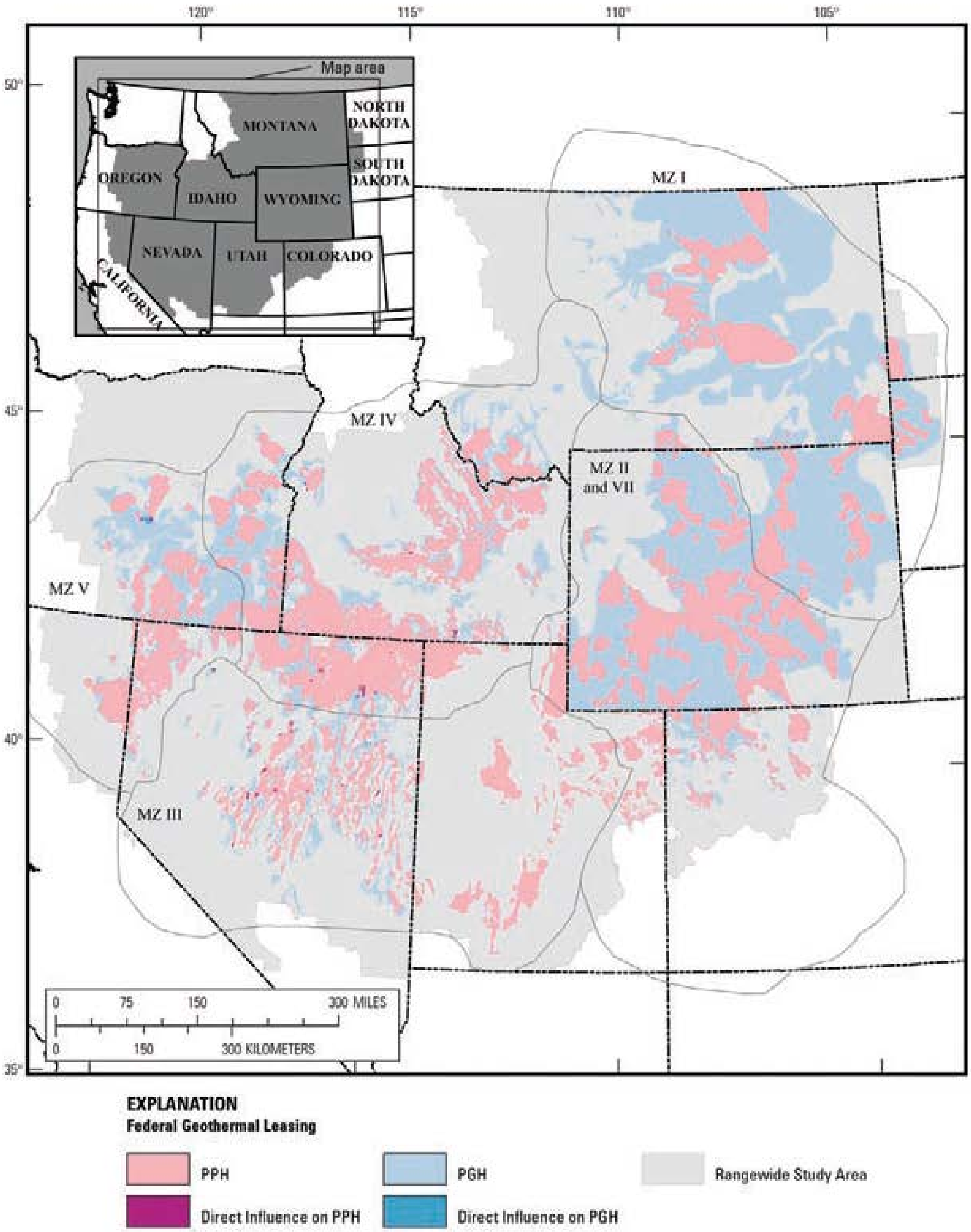

Figure 21*A*. Overlap of Federal geothermal leases with sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

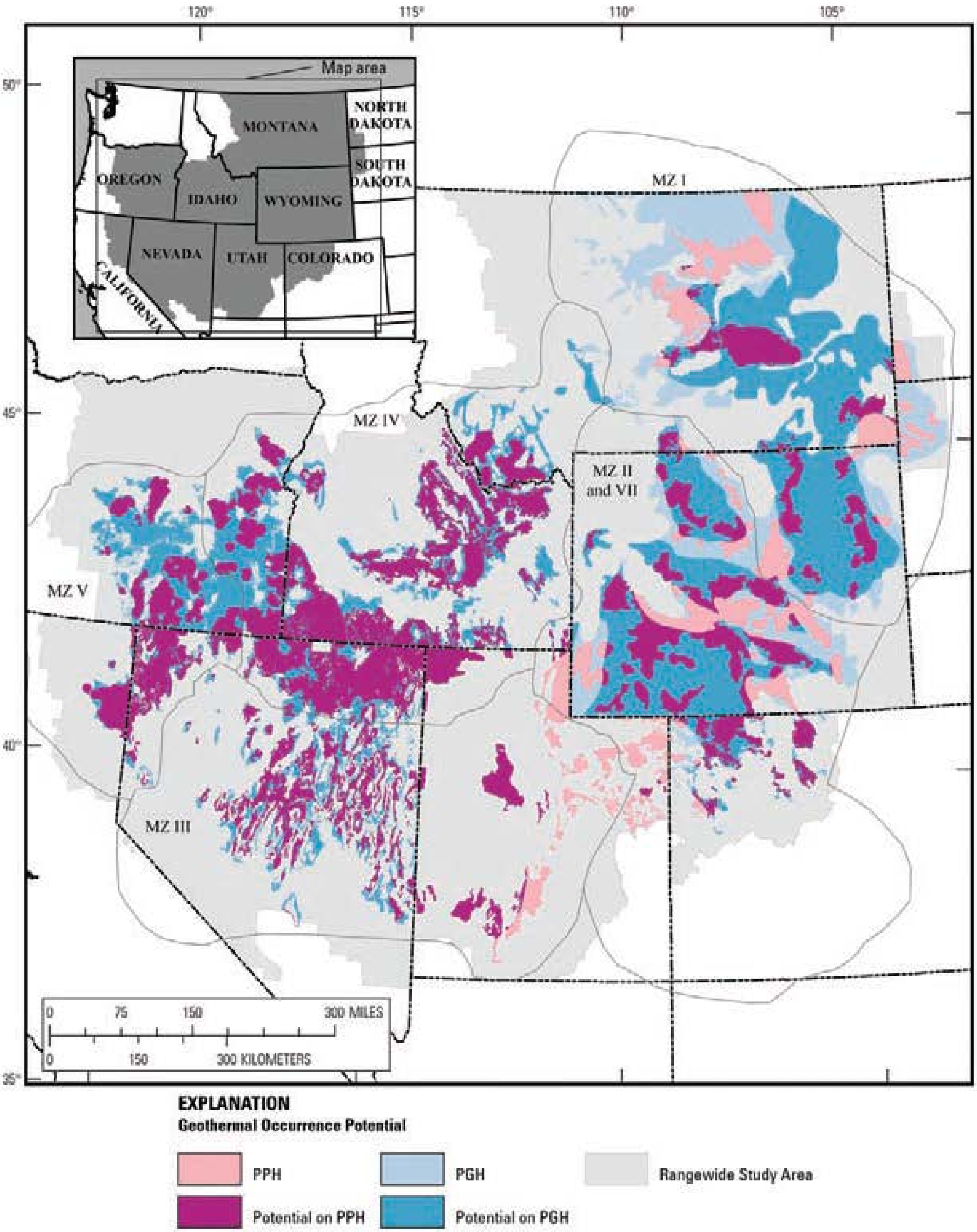

Figure 21*B*. Overlap of geothermal occurrence potential in sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 16. Summary of the direct and indirect influences of Federal surface coal leases* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH					PGH				
	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	19 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**5,700**	**335,900**	**0.05**	**2.89**	**34,663,000**	**202,600**	**2,685,600**	**0.58**	**7.75**
BLM	2,994,300	600	28,200	0.02	8	4,524,900	2,600	104,400	0.06	4
Forest Service	292,400	0	53,800	0.00	16	515,300	32,900	189,000	6.38	7
Tribal and Other Federal	219,700	0	100	0.00	0	2,427,700	0	14,100	0.00	1
Private	7,132,500	5,100	229,800	0.07	68	24,682,800	164,500	2,203,400	0.67	82
State	995,600	0	24,000	0.00	7	2,498,400	2,500	172,000	0.10	6
Other	1,900	0	0	0.00	0	13,900	0	2,700	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**16,400**	**1,325,000**	**0.09**	**7.58**	**19,200,200**	**35,700**	**1,873,200**	**0.19**	**9.76**
BLM	9,021,200	12,200	567,300	0.14	43	9,012,500	28,100	706,600	0.31	38
Forest Service	162,000	0	0	0.00	0	452,500	0	1,400	0.00	0
Tribal and Other Federal	784,000	2,400	31,000	0.31	2	1,354,600	0	5,700	0.00	0
Private	6,233,900	1,200	663,200	0.02	50	7,394,800	7,500	1,074,400	0.10	57
State	1,244,800	600	63,100	0.05	5	979,800	100	85,000	0.01	5
Other	30,100	0	300	0.00	0	6,000	0	100	0.00	0
MZ III–SGB	**10,028,500**	**1,500**	**63,300**	**0.01**	**0.63**	**3,970,100**	**0**	**0**	**0.00**	**0.00**
BLM	6,309,400	1,100	22,900	0.02	36	3,199,800	0	0	0.00	0
Forest Service	1,236,200	0	400	0.00	1	356,200	0	0	0.00	0
Tribal and Other Federal	260,800	0	0	0.00	0	29,100	0	0	0.00	0
Private	1,836,200	400	30,800	0.02	49	384,800	0	0	0.00	0
State	385,900	0	9,300	0.00	15	200	0	0	0.00	0
MZ IV–SRP	**21,930,600**	**0**	**0**	**0.00**	**0.00**	**10,958,500**	**0**	**0**	**0.00**	**0.00**
MZ V–NGB	**7,097,200**	**0**	**0**	**0.00**	**0.00**	**5,808,000**	**0**	**0**	**0.00**	**0.00**

*Data Source: Aggregated from individual BLM State Office Submissions in 2011 and 2012. Direct and indirect impacts are calculated for the surface management entity; however, subsurface mineral rights may be severed from surface rights.

[1]Direct footprint is the co-location of surface coal mines within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features (where Federal coal leases may be fully developed) and estimating the area affected. Indirect influence distance derived from area of identified demographic impact (Johnson and others, 2011; Taylor and others, 2012).

[2]For each MZ, calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within each management zone, calculated as the percent of the total indirect impact in the management zone represented by that management entity, that is, the relative area of indirect influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

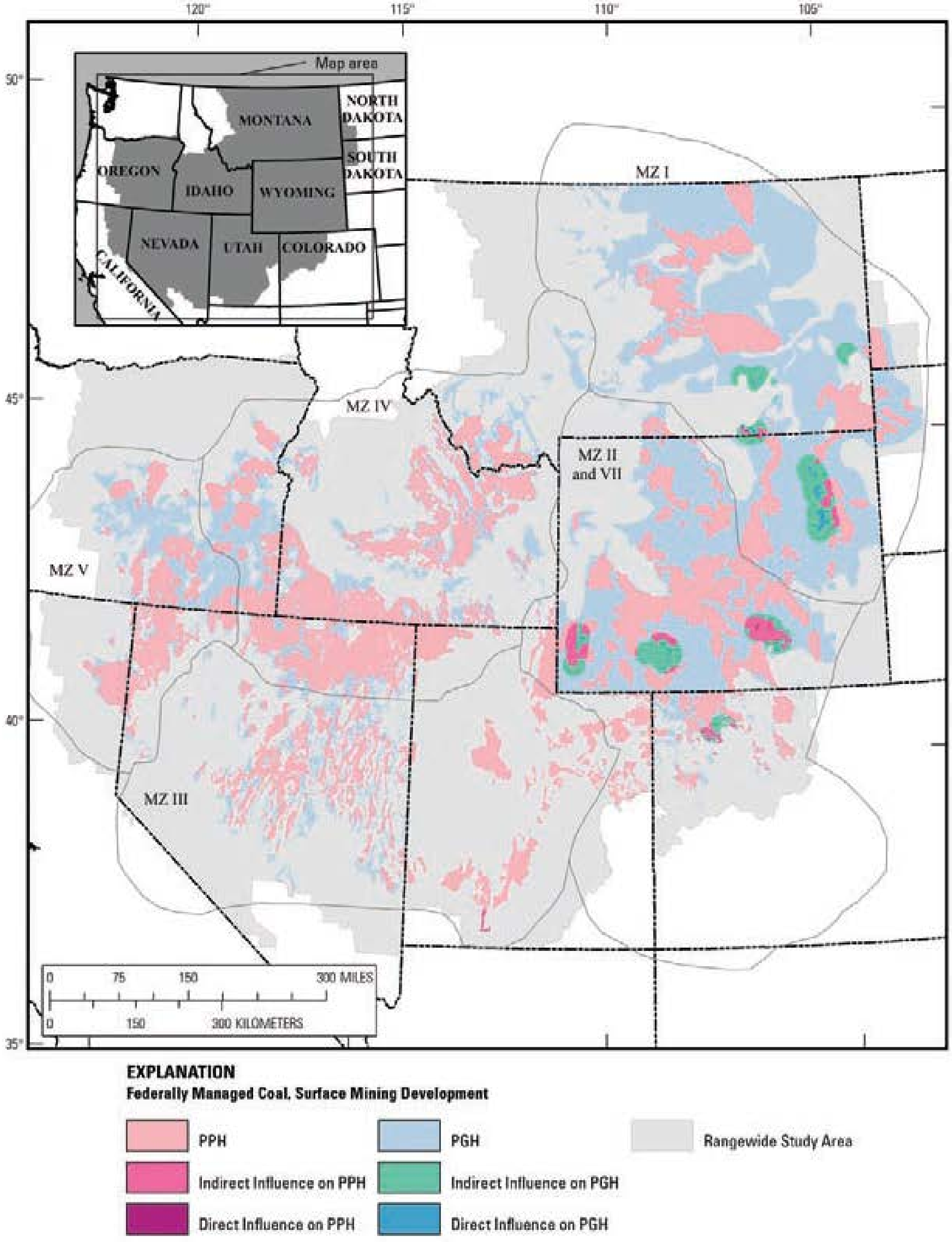

Figure 22. Overlap of Federally managed surface coal leases, potential indirect influences of these leases, and preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

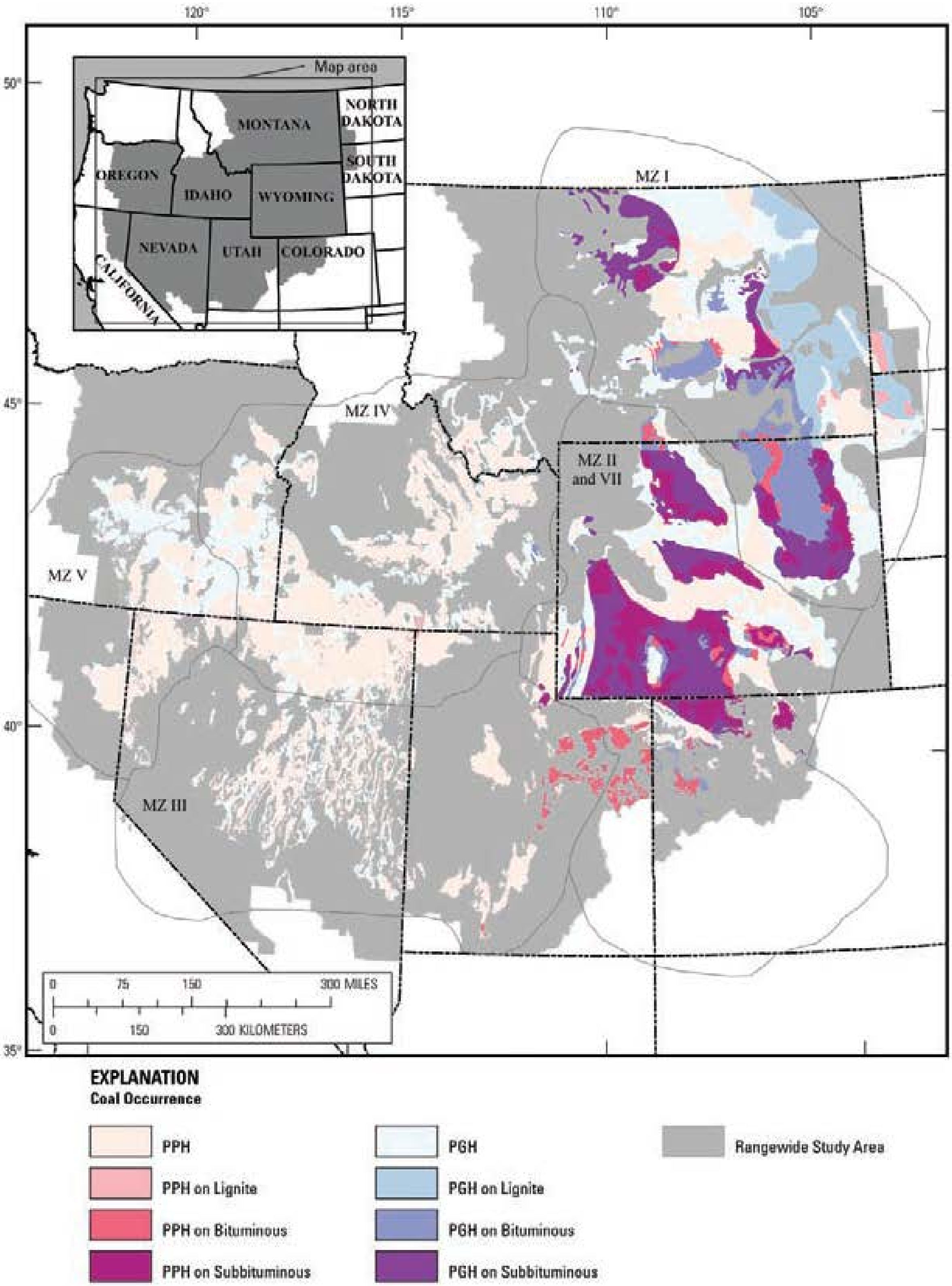

Figure 23. Overlap of coal occurrence and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 17A. Summary of the direct and indirect influences of mining and mineral materials disposal sites* (not including minerals mined as energy sources) across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH					PGH				
	SG Habitat (acres)	Direct Footprint[1] (acres)	2.5 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	2.5 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ I–GP	**11,636,400**	**122,900**	**687,500**	**1.06**	**5.91**	**34,663,000**	**504,000**	**1,994,700**	**1.45**	**5.75**
BLM	2,994,300	65,000	261,000	2.17	38	4,524,900	64,500	226,200	1.43	11
Forest Service	292,400	0	300	0.00	0	515,3	1,200	17,300	0.23	1
Tribal and Other Federal	219,700	0	1,100	0.00	0	2,427,700	0	800	0.00	0
Private	7,132,500	49,000	364,100	0.69	53	24,682,800	430,500	1,602,600	1.74	80
State	995,600	8,900	61,100	0.89	9	2,498,400	7,800	147,800	0.31	7
Other	1,900	0	0	0.00	0	13,900	0	0	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**582,100**	**2,947,000**	**3.33**	**16.86**	**19,200,200**	**445,400**	**2,177,700**	**2.32**	**11.34**
BLM	9,021,200	484,400	1,922,300	5.37	65	9,012,500	362,200	1,301,300	4.02	60
Forest Service	162,000	2,400	22,900	1.48	1	452,500	700	6,000	0.15	0
Tribal and Other Federal	784,000	0	7,200	0.00	0	1,354,600	2,200	43,200	0.16	2
Private	6,233,900	73,200	754,000	1.17	26	7,394,800	72,500	695,200	0.98	32
State	1,244,800	22,000	238,600	1.77	8	979,800	7,800	132,000	0.80	6
Other	30,100	100	2,000	0.33	0	6,000	0	0	0.00	0
MZ III–SGB	**10,028,500**	**914,800**	**3,263,700**	**9.12**	**32.54**	**3,970,100**	**478,800**	**1,620,600**	**12.06**	**40.82**
BLM	6,309,400	762,500	2,502,800	12.09	77	3,199,800	377,700	1,285,300	11.80	79
Forest Service	1,236,200	42,400	250,300	3.43	8	356,200	44,200	144,400	12.41	9
Tribal and Other Federal	260,800	100	14,000	0.04	0	29,100	0	6,100	0.00	0
Private	1,836,200	106,400	437,500	5.79	13	384,800	56,900	184,600	14.79	11
State	385,900	3,400	59,100	0.88	2	200	0	200	0.00	0
MZ IV–SRP	**21,930,600**	**719,100**	**4,320,800**	**3.28**	**19.70**	**10,958,500**	**330,500**	**1,872,400**	**3.02**	**17.09**
BLM	13,710,700	462,100	2,620,800	3.37	61	4,928,200	189,900	899,900	3.85	48
Forest Service	1,613,800	113,700	427,000	7.05	10	1,113,500	56,500	239,900	5.07	13
Tribal and Other Federal	633,600	500	27,900	0.08	1	522,500	400	11,700	0.08	1
Private	4,890,200	139,200	1,115,900	2.85	26	3,516,742	80,200	629,100	2.28	34
State	1,019,373	3,600	127,600	0.35	3	846,200	3,400	91,200	0.40	5
Other	62,900	0	1,500	0.00	0	31,400	0	600	0.00	0

Table 17A. Summary of the direct and indirect influences of mining and mineral materials disposal sites* (not including minerals mined as energy sources) across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH					PGH				
	SG Habitat (acres)	Direct Footprint[1] (acres)	2.5 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)	SG Habitat (acres)	Direct Footprint[1] (acres)	2.5 km Indirect Influence[1] (acres)	Direct Footprint[1] (%)	Relative Influence[2] (%)
MZ V–NGB	**7,097,200**	**75,900**	**549,400**	**1.07**	**7.74**	**5,808,000**	**43,400**	**469,200**	**0.75**	**8.08**
BLM	5,117,500	71,500	452,800	1.40	82	4,196,700	39,900	348,100	0.95	74
Forest Service	62,200	0	900	0.00	0	114,900	0	800	0.00	0
Tribal and Other Federal	717,100	900	27,100	0.13	5	101,800	300	10,200	0.29	2
Private	798,000	3,500	44,600	0.44	8	1,199,000	3,000	93,600	0.25	20
State	64,900	0	2,600	0.00	0	115,800	100	7,300	0.09	2
Other	337,500	0	21,300	0.00	4	79,800	100	9,200	0.13	2

*Data Source: Aggregated from individual BLM State Office Submissions in 2011 and 2012. Direct and indirect impacts are calculated for the surface management entity; however, subsurface mineral rights may be severed from surface rights.

[1]Direct footprint is the co-location of surface mining activities within the designated habitat boundaries, and indirect influence is inferred by applying an effect buffer to the features and estimating the area affected. Indirect influence distance derived from estimated spread of exotic plants (Bradley and Mustard, 2006).

[2]For each MZ, calculated as the percent of the particular sage-grouse habitat type influenced by the indirect impact of the threat. For management entities within management zones, calculated as the percent of the total indirect impact in the management zone represented by that management entity, that is, the relative area of indirect influence among management entities.

Table 17*B*. Summary of existing Federal mineral prospecting permits for non-energy, leasable resources* within preliminary priority and preliminary general sage-grouse habitats (PPH and PGH, respectively) by Management Zone (MZ).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH			PGH		
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)
MZ I–GP	11,636,400	10,400	0.09	34,663,000	28,200	0.08
MZ II and VII–WB & CP	17,476,000	378,400	2.17	19,200,200	557,100	2.90
MZ III–SGB	10,028,500	33,900	0.34	3,970,100	23,500	0.59
MZ IV–SRP	21,930,600	7,100	0.03	10,958,500	4,900	0.04
MZ V–NGB	7,097,200	0	0.00	5,808,000	0	0.00

*Aggregated from individual BLM State Office Submissions in 2011 and 2012. Overall acres for the valid existing right are reported for the MZ, however, note that subsurface mineral rights may be severed from surface rights.

perceived to be under direct threat from habitat loss, the ecological role of fire in releasing canopy dominance of sagebrush and stimulating systemic regeneration may justify the use of fire for management.

The historical role of fire in sagebrush ecosystems has been difficult to estimate accurately, yet this information is important for guiding fuel and habitat treatments. Sagebrush generally does not provide direct evidence of previous fires (such as scarred wood on surviving individuals), so historic estimates were based on neighboring ecosystems and approximation. Early estimates indicated a range of possible return intervals ranging from as few as 13 to 100 years (Brown, 1982; Wrobleski and Kauffman, 2003; Connelly and others, 2004; Crawford and others, 2004), but broad estimates extrapolated from local perspectives hide the complexity of this process within the sagebrush ecosystem. Using a robust approach to consider landscape heterogeneity and biotic potential along with evidence of previous disturbances, Baker (2011) described 200–350 year fire-return intervals in Wyoming sagebrush (*Art. tri. wyomingensis*), 150–300 years in mountain big sagebrush (*Art. tri.* ssp. *vaseyana*), and more than 200 years for little sagebrush (*Art. tri. arbuscula*). These values capture differences among sagebrush types and provide approximate time frames that support the juxtaposition of disturbance (fire) and recovery (in this case, re-colonization by sagebrush); additional information on fire and fire-return intervals, especially relating to particular ecological types and (or) conditions, is available in the literature (Nelle and others, 2000; Miller, 2001; West and Yorks, 2002; Mensing and others, 2006; Lesica and others, 2007; Miller and Heyerdahl, 2008), and consideration of these and other local details may be necessary for comprehensive planning and mitigation.

Fire regimes are complex and vary tremendously across the sagebrush region and through time; furthermore, the ecological role of fire has changed dramatically since the European settlement era (circa 1850) due to changing fuel and habitat patterns (Crawford and others, 2004). Though the presence and distribution of suitable sagebrush habitats is limited at landscape scales, precluding the need for disturbances to intact sagebrush communities (Beck and others, 2009), maintenance of healthy sagebrush communities includes some localized disturbances in many regions. Because of the slow recovery time of most sagebrush species (none of the native big sagebrush species truly sprout, although reproduction by layering [akin to sprouting] from the root-crown has been described in the mountain variety, *Art. tri.* ssp. *vaseyana;* Winward, 2004), patterns of fire-free periods within a region are very important in determining landscape composition, habitat structure, and fire behavior. Three-tip (*Art. tripartita*) may increase after fire because it sprouts; however, three-tip is less preferred by nesting grouse (Lowe and others, 2009). In some higher elevation habitats, where mountain big-sagebrush is the canopy dominant, rapid regeneration due to site potential, seed production, and layering can produce 25 percent cover within 20 years (Winward, 2004).

Information on the variability of fire and fire-free periods across this landscape over time is limited, but the vast sea of sagebrush described by trappers, early European settlers, and official surveys would not have been possible under high-frequency fire regimes (Baker, 2011). There is little evidence that fire will enhance sage-grouse habitat in Wyoming big sagebrush communities, especially where there is already a balance of native shrubs, perennial grasses, and forbs (Crawford and others, 2004).There is a growing body of evidence that suggests that on the current landscape even prescribed fire designed to enhance brood-rearing habitat values does not have positive effect on herbaceous habitat conditions and can cause demonstrable decline in valuable sagebrush cover (Beck and others, 2009). Therefore, use of fire is not recommended strictly for sagebrush habitat enhancement (Baker, 2006; Beck and others, 2009).

Due to increased fuel potentials caused by annual grasses (*Bromus tectorum, Taenatherum asperum*) and landscape-scale decrease in intact sagebrush habitats (fragmentation), wildfire

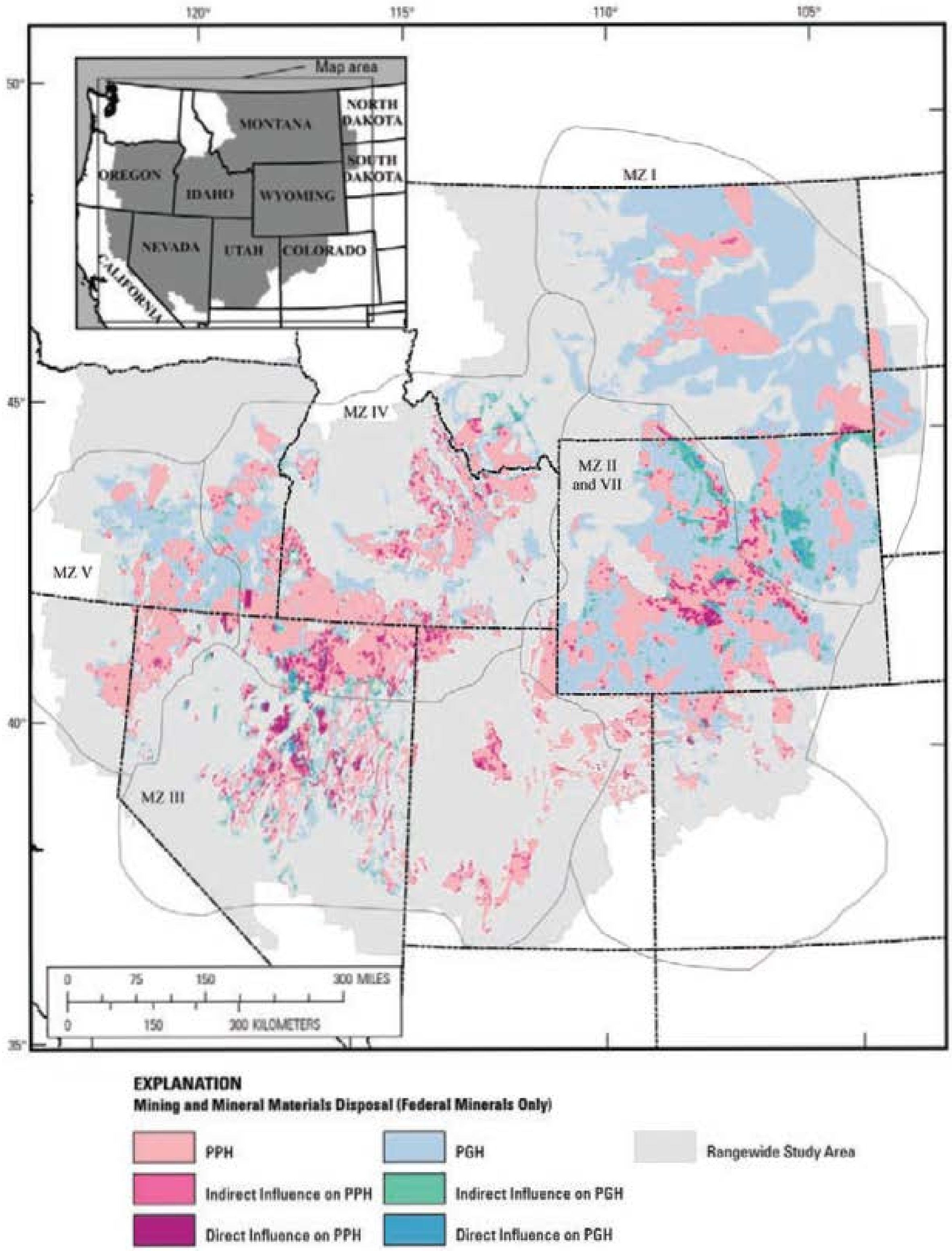

Figure 24. Overlap of Federal mining- and mineral-material disposal sites, potential indirect influences of these areas, and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

represents an important threat to habitat conservation and population stability (U.S. Fish and Wildlife Service, 2010b). Recent estimates indicate that the fire suppression era has had little effect on sagebrush ecosystem conditions due to the naturally long fire-return intervals (Baker, 2011); however, accumulation of fuels and volatile weather conditions may increase the importance of fuel breaks and related defense strategies for protecting priority habitats from wildfires. Current sage-grouse populations are limited by the distribution of suitable habitats, and near-term detrimental effects of fire on habitat suitability indicate a need to control fire in important sagebrush ecosystems. Ironically, the strategic use of fire to control fuels, as well as woodland expansion, may be warranted.

Assessment of fires reported to the National Interagency Fire Center (NIFC) occurring within designated habitats (PPH and PGH) from 2000–2012 (the years where reporting is considered to be mostly complete for fire perimeters rather than point locations for the study area) indicates that annual losses within most MZs have been minimal (2 percent or less); however, nearly 14 percent of PPH and 17 percent of PGH burned in MZ IV, 17 percent and 6 percent in MZ V (PPH and PGH, respectively), and 1.7 and 5.7 percent of MZ III (PPH and PGH, respectively) in recent years (2000–2012; table 18 and fig. 25). Wildfires in 2012 directly affected sagebrush habitats with sage-grouse populations in Nevada, California, Oregon, and Wyoming. Clearly, this time frame (one decade) is insufficient to assess the accumulation of fire and fire effects across the sagebrush landscape; however, this perspective is provided as a spatially consistent summary of recent fire occurrence that should be supplemented by additional data where available. Because the typical recovery time for sagebrush communities impacted by fire is several decades, the reporting period used here underrepresents some recent events that continue to affect habitat conditions, such as the large fires in the Great Basin during the late 1990s (BLM, 1999). Challenges related to fire and fuels management have become pronounced and sometimes extreme in the Great Basin (MZs III and V) and parts of the Snake River Plain (MZ IV) where cheatgrass has invaded, changed fuel profiles, and subsequently enhanced fire behavior by increasing surface intensity and decreasing return intervals (Knapp, 1996; Epanchin-Niell and others, 2009; Shinneman and Baker, 2009; Rowland and others, 2010; Baker, 2011; Condon and others, 2011). Minimizing disturbance within remnant sagebrush communities deemed important for sage-grouse conservation might include a combination of wildfire control as well as adjusting use standards (for example, grazing, energy development, and recreation) to avoid treatments and activities that remove sagebrush, degrade native herbaceous species, and (or) promote cheatgrass expansion. In areas with widespread loss of sagebrush and replacement with cheatgrass, active restoration may be required (see section III. A11. Habitat Treatments and Vegetation Management). Revegetation following fire is expensive compared to letting "natural regeneration processes" run their course, but the opportunity to reduce fire potential, increase forage quality, and increase habitat quality based on intensive revegetation efforts may justify these actions in some habitats (Epanchin-Niell and others, 2009). For example, stabilization of surface soils, prevention of noxious weed infestations, and re-establishment of native species are important vegetation management priorities, which may benefit from post-fire rehabilitation. Research and development of cheatgrass control strategies are ongoing, but management of the fire-return interval and fuel profile created by cheatgrass is recognized as a fundamental component of cheatgrass control efforts. Further, support and enhancement of deep-rooted, native, perennial plants may be important in the control of cheatgrass and post-disturbance response of the community (Balch and others, 2012).

Although precise occurrence of future fire is impossible to determine due to complicated interactions of weather, vegetation, and ignition, the distribution of fuel profiles have been used to estimate probability for development of large fires (see National Interagency Fire Center Geographic Area Coordination Centers Web site at *http://gacc.nifc.gov/rmcc/predictive/firedngr.htm*). Fuel models indicate vast acreages in all MZs, which are susceptible to fire with the most dramatic numbers occurring in MZs III, IV and V (63 percent, 84 percent, and 68 percent of PPH, and 60 percent, 76 percent, and 64 percent of PGH, respectively; table 19 and fig. 26)

In contrast, lack of fire at higher elevations, where moisture and productivity are greater than neighboring communities at lower elevations, has contributed to an increase in juniper cover (Miller and Rose, 1995; Miller and others, 2000; Miller and Heyerdahl, 2008; Sankey and Germino, 2008; Shinneman and others, 2008; Bradley, 2010). In these areas, active restoration using fire or "fire-mimic" (mechanical) treatments may be needed to maintain sage-grouse habitats by reducing juniper cover (Bradley, 2010; Rowland and others, 2010). Importantly, all sites do not have equal restoration potential, with the greatest potential being in the least altered locations where vegetation and soils can readily recover (Shinneman and others, 2008), but recovery processes may be supported and enhanced through methods and timing of application (Bates and others, 2011; Rau and others, 2011).

Because of the important value of sagebrush canopies and tall grasses for nesting cover (Holloran and others, 2005; Beck and others, 2009), wildfires and prescribed fires (and treatments with similar effects on vegetation) that reduce these values are likely detrimental for sage-grouse. On the other hand, fire control and mitigation represents an important component of modern habitat management due to the recently perceived (circa 50 years) threat of wildfire in many areas, including sage-grouse habitats (fig. 26). Particular caution and concern is warranted when noxious invasive species (notably, but not limited to, cheatgrass) are present in the pre-disturbance community because these species may have lasting, detrimental effects on post-disturbance habitat conditions. The threat of large wildfires in priority habitats, potentially resulting in removal of large stands of mature sagebrush, remains one of the most important and difficult to control obstacles to sage-grouse conservation.

Table 18. Summary of fires reported[*] to National Interagency Fire Center between 2000–2012, across Management Zones (MZ) by acres within preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH						PGH					
	SG Habitat (acres)	Yearly Max Area Burned (acres)	Yearly Min Area Burned	Average Area Burned (acres/yr)	Area Burned 2000–2012 (%)	Relative Influence[1] (%)	SG Habitat (acres)	Yearly Max Area Burned (acres)	Yearly Min Area Burned	Average Area Burned (acres/yr)	Area Burned 2000–2012 (%)	Relative Influ-ence[1] (%)
MZ I–GP	**11,636,400**	**70,900**	**100**	**14,329**	**1.6**		**34,663,000**	**279,700**	**100**	**66,223**	**2.5**	
BLM	2,994,300	10,800	0	2,212	1.0	15	4,524,900	24,600	0	7,389	2.1	11
Forest Service	292,400	1,000	0	136	0.6	1	515,300	34,600	0	3,148	7.9	5
Tribal and Other Federal	219,700	22,100	0	1,702	10.1	12	2,427,700	29,500	0	3,673	2.0	6
Private	7,132,500	55,500	0	8,990	1.6	63	24,682,800	189,300	0	47,778	2.5	72
State	995,600	6,100	0	1,289	1.7	9	2,498,400	19,400	0	4,235	2.2	6
Other	1,900	0	0	0	0.0	0	13,900	0	0	0	0.0	0
MZ II and VII–WB & CP	**17,476,000**	**27,100**	**200**	**7,661**	**0.6**		**19,200,200**	**161,100**	**400**	**24,046**	**1.6**	
BLM	9,021,200	8,100	0	2,943	0.4	38	9,012,500	25,500	200	4,989	0.7	21
Forest Service	162,000	8,800	0	966	7.7	13	452,500	6,800	0	913	2.6	4
Tribal and Other Federal	784,000	13,600	0	1,388	2.3	18	1,354,600	126,000	0	10,062	9.7	42
Private	6,233,900	4,500	100	1,411	0.3	18	7,394,800	34,200	100	7,019	1.2	29
State	1,244,800	8,100	0	953	1.0	12	979,800	4,800	0	1,062	1.4	4
Other	30,100	0	0	0	0.0	0	6,000	0	0	0	0.0	0
MZ III–SGB	**10,028,500**	**55,900**	**0**	**13,500**	**1.8**		**3,970,100**	**55,000**	**0**	**17,577**	**5.8**	
BLM	6,309,400	44,700	0	9,397	1.9	70	3,199,800	30,900	0	9,394	3.8	53
Forest Service	1,236,200	3,100	0	527	0.6	4	356,200	4,600	0	468	1.7	3
Tribal and Other Federal	260,800	1,100	0	129	0.6	1	29,100	900	0	68	3.1	0
Private	1,836,200	9,300	0	2,559	1.8	19	384,800	26,800	0	7,646	25.8	43
State	385,900	4,300	0	888	3.0	7	200	0	0	0	0.0	0

Table 18. Summary of fires reported* to National Interagency Fire Center between 2000–2012, across Management Zones (MZ) by acres within preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH						PGH					
	SG Habitat (acres)	Yearly Max Area Burned (acres)	Yearly Min Area Burned	Average Area Burned (acres/yr)	Area Burned 2000–2012 (%)	Relative Influence[1] (%)	SG Habitat (acres)	Yearly Max Area Burned (acres)	Yearly Min Area Burned	Average Area Burned (acres/yr)	Area Burned 2000–2012 (%)	Relative Influence[1] (%)
MZ IV–SRP	**21,930,600**	**1,030,400**	**0**	**239,769**	**14.2**		**10,958,500**	**442,900**	**0**	**144,147**	**17.1**	
BLM	13,710,700	790,600	0	181,646	17.2	76	4,928,200	361,000	0	101,975	26.9	71
Forest Service	1,613,800	89,700	0	9,509	7.7	4	1,113,500	117,500	0	14,015	16.4	10
Tribal and Other Federal	633,600	53,000	0	5,407	11.1	2	522,500	64,200	0	8,876	22.1	6
Private	4,890,200	189,000	0	37,313	9.9	16	3,516,742	69,400	0	16,024	5.9	11
State	1,019,373	30,500	0	4,954	6.3	2	846,200	12,600	0	3,147	4.8	2
Other	62,900	11,500	0	940	19.4	0	31,400	1,400	0	110	4.6	0
MZ V–NGB	**7,097,200**	**950,500**	**0**	**95,441**	**17.5**		**5,808,000**	**136,000**	**0**	**25,900**	**5.8**	
BLM	5,117,500	877,700	0	83,677	21.3	88	4,196,700	124,300	0	21,670	6.7	84
Forest Service	62,200	2,000	0	199	4.2	0	114,900	7,700	0	1,086	12.3	4
Tribal and Other Federal	717,100	7,500	0	1,082	2.0	1	101,800	800	0	111	1.4	0
Private	798,000	45,600	0	7,091	11.6	7	1,199,000	9,700	0	2,750	3.0	11
State	64,900	4,100	0	411	8.2	0	115,800	2,500	0	213	2.4	1
Other	337,500	22,900	0	2,981	11.5	3	79,800	900	0	70	1.1	0

*Data Source: Geospatial Multi-Agency Coordination (GeoMAC) Group, 2012.

[1]For management entities within a Management Zone, calculated as the percent of the total acres burned during the time period within the management zone represented by that management entity, that is, the relative area of direct influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations; regional averages were calculated independently from entity estimates; therefore, items in columns with averages may not sum equivalently.

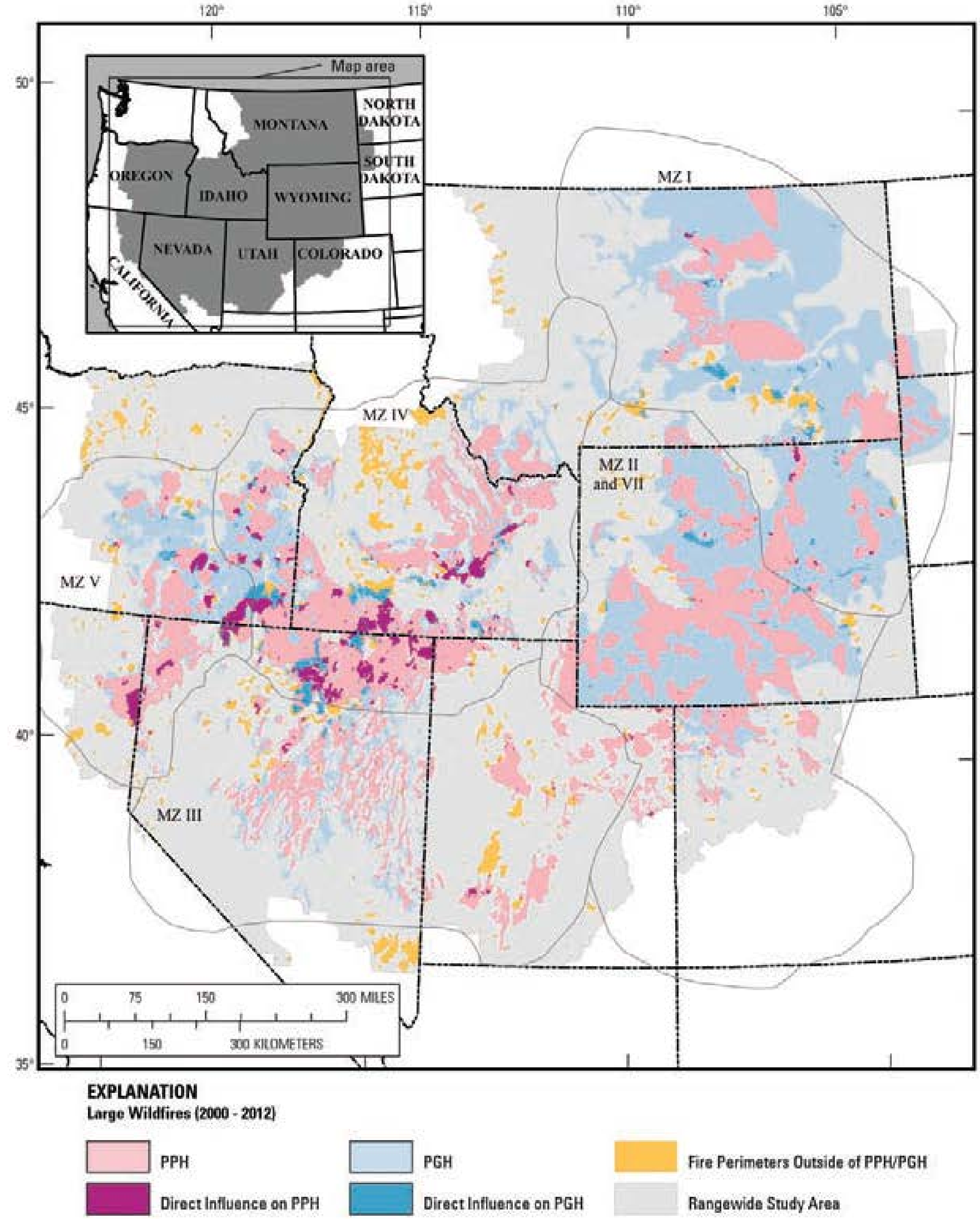

Figure 25. Overlap of fires reported to National Interagency Fire Center between 2000–2012 and preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

Table 19. Summary of areas with fuel models* that project a high probability of developing large fires across each management Zone (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	High Burn Probability (acres)	High Burn Probability (%)	Relative Influence[1] (%)	SG Habitat (acres)	High Burn Probability (acres)	High Burn Probability (%)	Relative Influence[1] (%)
MZ I–GP	**11,636,400**	**1,921,000**	**16.5**		**34,663,000**	**6,140,700**	**17.7**	
BLM	2,994,300	299,200	10.0	16	4,524,900	718,800	15.9	12
Forest Service	292,400	124,900	42.7	7	515,300	208,800	40.5	3
Tribal and Other Federal	219,700	39,600	18.0	2	2,427,700	67,800	2.8	1
Private	7,132,500	1,271,600	17.8	66	24,682,800	4,621,600	18.7	75
State	995,600	185,800	18.7	10	2,498,400	523,700	21.0	9
Other	1,900	0	0.0	0	13,900	0	0.0	0
MZ II and VII–WB & CP	**17,476,000**	**2,104,300**	**12.0**		**19,200,200**	**1,678,400**	**8.7**	
BLM	9,021,200	862,000	9.6	41	9,012,500	402,600	4.5	24
Forest Service	162,000	31,100	19.2	1	452,500	182,700	40.4	11
Tribal and Other Federal	784,000	180,100	23.0	9	1,354,600	435,900	32.2	26
Private	6,233,900	871,200	14.0	41	7,394,800	593,300	8.0	35
State	1,244,800	151,600	12.2	7	979,800	62,700	6.4	4
Other	30,100	8,400	27.9	0	6,000	1,300	21.7	0
MZ III–SGB	**10,028,500**	**6,312,300**	**62.9**		**3,970,100**	**2,391,600**	**60.2**	
BLM	6,309,400	4,583,100	72.6	73	3,199,800	1,990,900	62.2	83
Forest Service	1,236,200	280,500	22.7	4	356,200	78,900	22.2	3
Tribal and Other Federal	260,800	120,000	46.0	2	29,100	6,500	22.3	0
Private	1,836,200	1,137,600	62.0	18	384,800	315,200	81.9	13
State	385,900	191,000	49.5	3	200	100	50.0	0
MZ IV–SRP	**21,930,600**	**18,423,300**	**84.0**		**10,958,500**	**8,305,700**	**75.8**	
BLM	13,710,700	11,904,200	86.8	65	4,928,200	4,438,100	90.1	53
Forest Service	1,613,800	1,163,200	72.1	6	1,113,500	621,400	55.8	7
Tribal and Other Federal	633,600	487,200	76.9	3	522,500	301,900	57.8	4
Private	4,890,200	4,068,100	83.2	22	3,516,742	2,268,400	64.5	27
State	1,019,373	738,700	72.5	4	846,200	649,700	76.8	8
Other	62,900	62,000	98.6	0	31,400	26,300	83.8	0

Table 19. Summary of areas with fuel models* that project a high probability of developing large fires across each Management Zone (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	High Burn Probability (acres)	High Burn Probability (%)	Relative Influence[1] (%)	SG Habitat (acres)	High Burn Probability (acres)	High Burn Probability (%)	Relative Influence[1] (%)
MZ V–NGB	**7,097,200**	**4,858,900**	**68.5**		**5,808,000**	**3,729,300**	**64.2**	
BLM	5,117,500	3,545,800	69.3	73	4,196,700	2,801,300	66.8	75
Forest Service	62,200	29,900	48.1	1	114,900	40,300	35.1	1
Tribal and Other Federal	717,100	351,100	49.0	7	101,800	77,000	75.6	2
Private	798,000	589,400	73.9	12	1,199,000	689,500	57.5	18
State	64,900	49,300	76.0	1	115,800	74,200	64.1	2
Other	337,500	293,200	86.9	6	79,800	47,100	59.0	1

*Data Source: National Interagency Fire Center (NIFC) 2012, Geographic Area Coordination Centers, available at *http://gacc.nifc.gov/rmcc/predictive/firedngr.htm*.

[1]For management entities within a Management Zone, calculated as the percent of the total direct impact in the management zone represented by that management entity that is, the relative area of direct influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

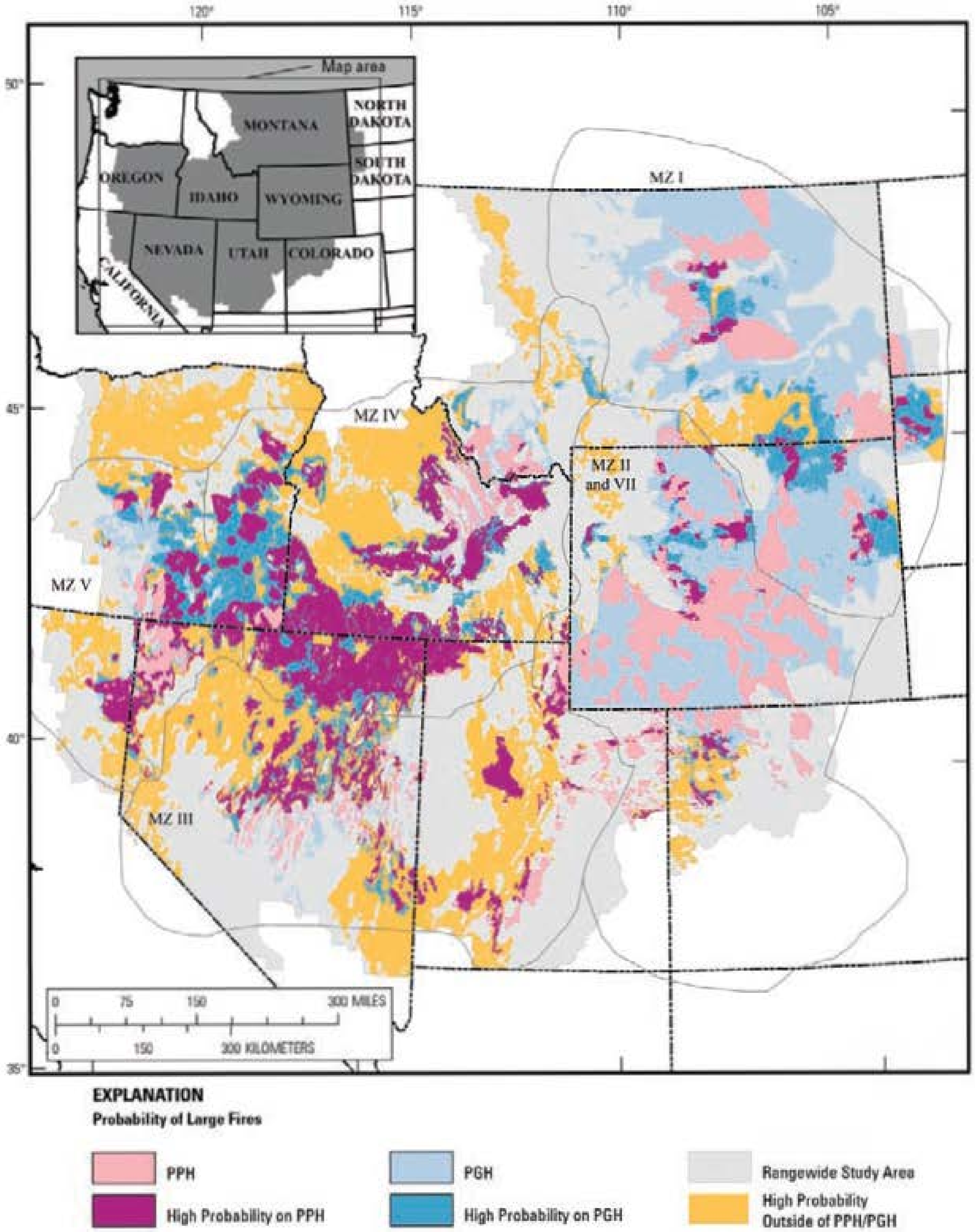

Figure 26. Overlap of areas modeled with a high probability for occurrence of large fires and preliminary priority and preliminary general habitats (PPH and PGH, respectively). MZ, Management Zone.

A7. Invasive Plants

Because of the strong interactions between disturbance, niche availability, and the "colonist" nature of most invasive species, presence of invasive species is a mechanism whereby a disturbance holds the potential for a strong, negative effect on habitat quality due to the post-disturbance response (Crawford and others, 2004). In Wyoming big sagebrush types, especially in the Great Basin (all or part of MZs III, IV, and V), the invasion by exotic annuals has resulted in dramatic increases in number and frequency of fires with widespread, detrimental effects on habitat conditions (Young and Evans, 1978; West and Young, 2000; West and Yorks, 2002; Connelly and others, 2004). For example, big sagebrush communities invaded by cheatgrass have estimated mean fire-return intervals of less than 10 years in many areas (Connelly and others, 2004), whereas the natural regime is estimated (conservatively) to be 10 to 20 times longer. Increased fire frequency or intense fire behavior typically results in removal of the sagebrush canopy in affected areas and often with replacement by annual species that provide little, to no, habitat value (Knapp, 1996; Epanchin-Niell and others, 2009; Rowland and others, 2010; Baker, 2011; Condon and others, 2011). Presumably cheatgrass (*Bromus tectorum*) was able to thrive in this region, in part because there was no pre-existing (native) dominant annual plant species. As this optimal colonist species established, chronic grazing by cattle, sheep, and horses combined with drought and fire to increase the distribution and frequency of disturbance and further optimize this region for dominance by an annual grass (Knapp, 1996). Importantly, research in sagebrush ecosystems has revealed an inverse relation between cheatgrass dominance and native perennial herbs, especially grasses (West and Yorks, 2002). Further, the post-disturbance response of sagebrush communities to fire and similar disturbances is strongly affected by the condition and composition before disturbance, the presence of propagules, and sprouting of native species (West and Yorks, 2002; Beck and others, 2009; Epanchin-Niell and others, 2009; Condon and others, 2011). Cheatgrass competes with native grasses and forbs that are important components of sage-grouse habitat. Cheatgrass abundance is negatively correlated with habitat selection by sage-grouse (Kirol and others, 2012) indicating that changes in composition and structure associated with cheatgrass specifically degrade sage-grouse habitat. Invasion by Medusahead (*Taeniatherum caput-medusae*), which can replace cheatgrass in some circumstances, may be even worse as it also reduces perennial productivity, degrades wildlife habitat, supports high-frequency fire-return intervals, and requires intensive treatment for restoration (Davies, 2010). Infestation of these species, and others, cause direct degradation of sagebrush habitats resulting in (indirect) effects on local sage-grouse populations by affecting forage and cover quality with potential to cause complete avoidance (funtional habitat loss).

In southern habitats (MZs III, IV, V, and VII), cheatgrass is found primarily at elevations between 5250 and 6550 ft (1,600–2,000 m), compared to 1950 to 5900 ft (600–1,800 m) in the sagebrush-steppe of Idaho and has been expanding in habitats below to 3900 ft (1,200 m; Connelly and others, 2004). Large-scale restoration is needed in many areas, making minimally invaded areas highly valuable for habitat conservation. In the sagebrush-steppe of northern habitats (all or parts of MZs I, II, IV, V, and VI), cheatgrass is less ubiquitous but demonstrates increased dominance, productivity, and elevation range on south-facing slopes (Connelly and others, 2004), which indicates the need for careful local considerations and best-practices that minimize disturbance in areas with a threat (presence) of cheatgrass expansion. Potential for cheatgrass occurrence has been modeled in the Great Basin region based on environmental correlations, which can help discern locations and habitats that have the greatest risk, either because cheatgrass is already on those landscapes (some of the risk has been realized) or the conditions are right to support cheatgrass (fig. 27*A*). Summary data indicate that invasion potential is widespread and similar among assessed MZs (table 20). Although the distribution of cheatgrass, and other annual invaders such as Japanese brome (*Bromus arvensis*), has been documented across shrub and grasslands of Colorado, Wyoming, and Montana, the currently available model was only parameterized for the Great Basin, therefore only MZs III, IV and V are described here (table 20, fig. 27*A*). Similar information is being developed rangewide, as well as with subregional details. Due to the emerging nature of invasive plants, especially cheatgrass, information and rapid changes in species' distributions, details of invasion, control, and risks will be best provided by local information and subregional to regional-scale models. Data presented here demonstrate the potential risk to priority habitats within the Great Basin and Snake River Plain based on a spatial model developed using field observations and geographic information system (GIS) representation of dominant environmental patterns (that predict and [or] restrict the distribution of the species). Model results suggest the most serious risk of cheatgrass invasion (in these analytical units) lies in the Snake River Plain where more than 50 percent of PPH and PGH are projected to be at risk of cheatgrass invasion (table 20). Assessment of regional habitat management issues by Wisdom and others (2005) highlighted concerns regarding expansion risk for cheatgrass and further specified the need for active restoration methods to improve sagebrush habitat conditions where fire and invasive species represent an interactive threat. The northern Great Basin follows this pattern closely with nearly 50 percent of preliminary priority habitats (PPH) and 36 percent of preliminary general habitats (PGH) threatened according to this independent, non-overlapping estimate, and similarly 31 percent and 43 percent of PPH and PGH, respectively, of the southern Great Basin MZ III is projected to share this level of risk. Importantly, most (more than 50 percent) of the affected lands in each MZ are managed by BLM and $< 2\%$ of the affected areas are USFS managed shrublands according to these data (table 20).

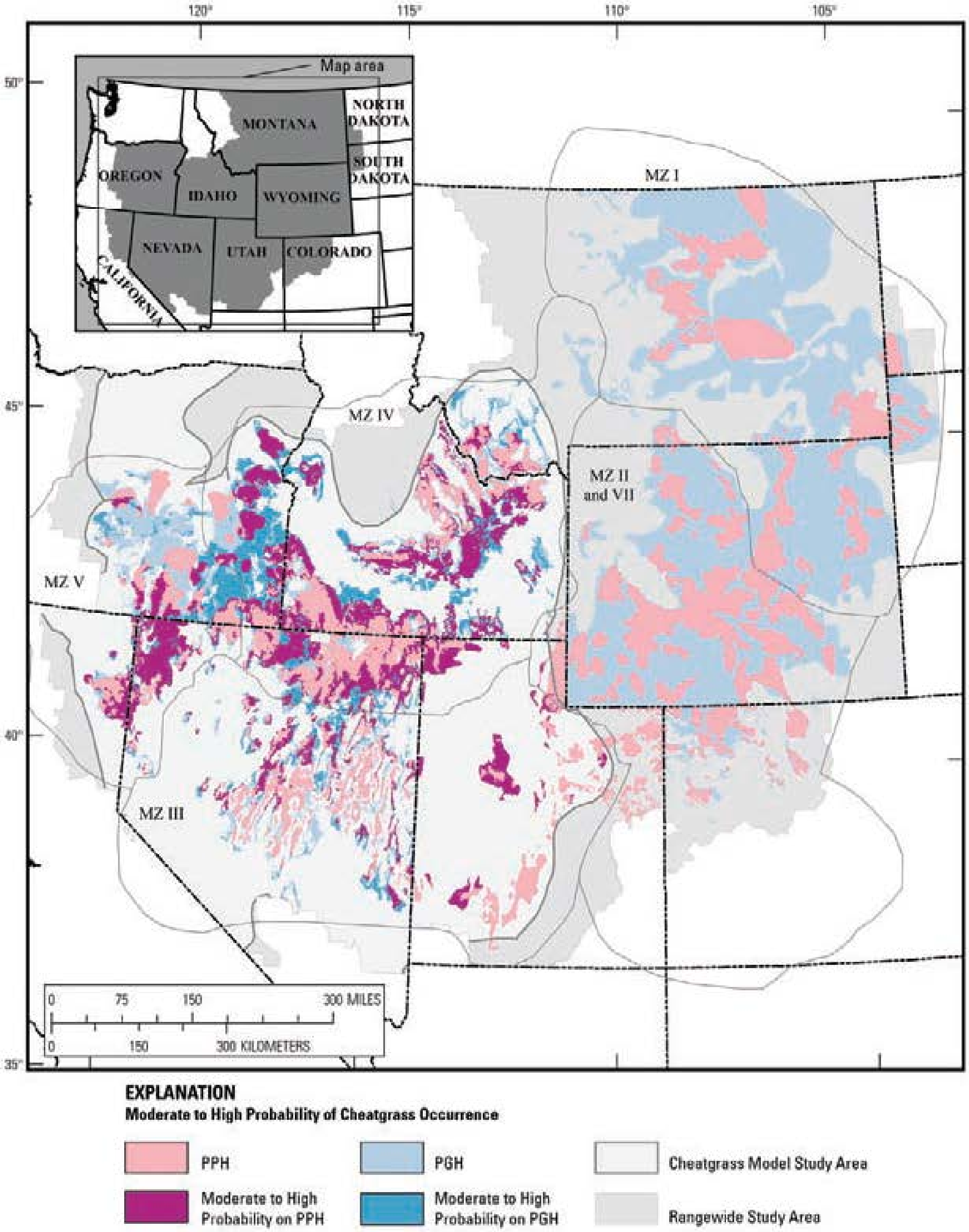

Figure 27*A*. Overlap of moderate to high probability of cheatgrass occurrence and preliminary priority and preliminary general habitats (PPH and PGH, respectively) in Management Zones III, IV and V (Great Basin) from logistic regression models. MZ, Management Zone.

Table 20. Summary of lands with moderate to high probability for cheatgrass occurrence* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)
MZ I–GP	**11,636,400**	**n/a**	**n/a**	**n/a**	**34,663,000**	**n/a**	**n/a**	**n/a**
MZ II and VII–WB & CP	**17,476,000**	**n/a**	**n/a**	**n/a**	**19,200,200**	**n/a**	**n/a**	**n/a**
MZ III – SGB	**10,028,500**	**3,143,000**	**31.3**		**3,970,100**	**1,716,800**	**43.2**	
BLM	6,309,400	2,154,300	34.1	69	3,199,800	1,400,200	43.8	82
Forest Service	1,236,200	72,500	5.9	2	356,200	33,900	9.5	2
Tribal and Other Federal	260,800	90,500	34.7	3	29,100	8,800	30.2	1
Private	1,836,200	723,600	39.4	23	384,800	273,900	71.2	16
State	385,900	102,000	26.4	3	200	0	0.0	0
MZ IV–SRP	**21,930,600**	**11,657,100**	**53.2**		**10,958,500**	**6,401,100**	**58.4**	
BLM	13,710,700	7,796,700	56.9	67	4,928,200	3,542,300	71.9	55
Forest Service	1,613,800	176,000	10.9	2	1,113,500	140,800	12.6	2
Tribal and Other Federal	633,600	458,900	72.4	4	522,500	304,900	58.4	5
Private	4,890,200	2,732,800	55.9	23	3,516,742	1,909,500	54.3	30
State	1,019,373	459,700	45.1	4	846,200	474,100	56.0	7
Other	62,900	33,000	52.5	0	31,400	29,500	93.9	0
MZ V–NGB	**7,097,200**	**3,521,300**	**49.6**		**5,808,000**	**2,096,700**	**36.1**	
BLM	5,117,500	2,590,200	50.6	74	4,196,700	1,483,600	35.4	71
Forest Service	62,200	23,200	37.3	1	114,900	11,700	10.2	1
Tribal and Other Federal	717,100	625,900	87.3	18	101,800	40,100	39.4	2
Private	798,000	176,100	22.1	5	1,199,000	502,100	41.9	24
State	64,900	17,700	27.3	1	115,800	33,600	29.0	2
Other	337,500	88,200	26.1	3	79,800	25,500	32.0	1

*Data Source: Meinke, C.W., S.T. Knick, and D.A. Pyke (2009). A spatial model to prioritize sagebrush landscapes in the intermountain west (U.S.A.) for restoration. Restoration Ecology 17:652–659.

[1]For management entities within a Management Zone, these were calculated as the percent of the total direct impact in the management zone represented by that management entity, that is, the relative area of direct influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

Because of ecological and morphological characteristics, cheatgrass can often out-compete native perennial plants and promote rapid fire-return intervals (Klemmedson and Smith, 1964; Connelly and others, 2004). The positive feedback cycle connecting fire, sagebrush loss, and cheatgrass dominance has resulted in entire landscapes being converted to annual grasslands (D'Antonio and others, 2009), and these areas typically require active restoration, including costs and effort, associated with eradication of weeds and reseeding of native species, if local priorities indicate important potential habitat value for restored lands. Based on the scale of such efforts, locally planned and implemented sagebrush restoration efforts will likely benefit from planning and perspectives provided by regional scales to strategically combat the spread and dominance of invasive annuals in priority habitats and connected areas.

Invasive plants are thought to alter plant community structure and composition, productivity, nutrient cycling, and hydrology (Vitousek, 1990) and may competitively exclude native plant populations (Mooney and Cleland, 2001). In particular, invasive plants can reduce and eliminate vegetation that sage-grouse use for food and cover resulting in habitat loss and fragmentation. An assortment of nonnative annuals and perennials and native conifers are currently invading sagebrush ecosystems. Many areas throughout the range of sage-grouse are at high risk from invasive plants, yet the most concentrated areas of risk include the Intermountain West and Great Basin (MZs III, IV, V, and VI). Much of the Great Basin is at risk for invasion by cheatgrass or pinyon-juniper encroachment within the next 30 years (Wisdom and others, 2005; Leu and others, 2008; Doherty and others, 2008), and where cheatgrass has invaded, there has typically been an increase in fire frequency resulting in further degradation of sage-grouse habitats by removing and excluding sagebrush (Knapp, 1996; Epanchin-Niell and others, 2009; Rowland and others, 2010; Baker, 2011; Condon and others, 2011). Regions that are currently invaded or predicted by distribution models to be highly susceptible may benefit from explicit guidance and practices that avoid, eliminate, or mitigate feedbacks in this cycle, including natural disturbances, over-grazing, treatments, new roads, and industrial developments that disrupt native vegetation cover and destabilize soils. Disrupting the processes that generate chronic disturbance and thereby facilitate dominance of annual plants is a necessary first step in the restoration and conservation process. Even at low levels, invasive plants can decrease forage quality and compete with native species that provide high-quality habitat values for sage-grouse and productive agricultural systems for people. This decline can be expected to cause a decrease in secondary productivity (in this case, sage-grouse), but potential for infestation, upon disturbance, with more significant implications for conditions must be an important consideration when problem species are present. In cases of severe infestation, system phenology (timing of green-up), cover and forage quality, and fire regimes are often altered with widespread, severe, and detrimental effects on sage-grouse habitat conditions. The relation between cheatgrass and fire in degrading sagebrush habitats is well documented, and this interaction continues to challenge management and restoration efforts—considerable research and development effort is needed to reduce this threat (Wisdom and others, 2005).

A8. Conifer Woodland Expansion and Encroachment

Expansion of conifer woodlands, especially juniper (*Juniperus* spp.) present a threat to sage-grouse because they do not provide suitable habitat, and further, mature trees displace shrubs, grasses and forbs through direct competition for resources that are important components of sage-grouse habitat; juniper expansion is associated with increased bare ground and an increased potential for erosion (Petersen and others, 2009). Mature trees may offer perch sites for raptors, thereby, woodland expansion may also represent expansion of raptor predation threat, similar to perches on power lines, poles and other structures (also see Section III. C. Predation). Although the prolonged drought at the beginning of the 21st century (2002–2004) caused significant (55 percent) mortality of mature pinyon pine (Clifford and others, 2011), reducing the threat attributed to this species in some areas, increased pinyon-juniper forest density and distribution continue to be documented following the drought period and are recognized as a threat to the sagebrush ecosystem in other areas (Romme and others, 2009; Bradley, 2010; Rowland and others, 2010). Intensive grazing in the late 1800s and early 1900s, coupled with climate and fire, have been associated with invasion of annual grasses at lower elevations and expansion of juniper and pinyon pine at higher elevations (Burkhardt and Tisdale, 1976; Miller and others, 1994; Provencher and others, 2007; Miller and others, 2011). Precipitation and fire are thought to drive long-term trends in cover (Clifford and others, 2011; Miller and others, 2011), and disturbance-free periods coupled with grazing that reduced competition and precipitation that supplied moisture for seedlings increased success of tree establishment and woodland expansion during the 20th century (Miller and Rose, 1995; Strand and others, 2007; Miller and others, 2011). In some areas (best documented in MZs III, IV, and V, and VI), conifer encroachment is connected to reduced habitat quality in important seasonal ranges when woodland development is sufficient to restrict shrub and herbaceous production (Connelly and others, 2004). Though widespread, this problem affects specific sagebrush habitats and sage-grouse populations because of local juniper and pinyon-juniper woodland expansions; notably, USFS research indicated more than 55 percent of Great Basin sagebrush ecosystems (MZs III and V) are at risk of cheatgrass invasion, whereas approximately 40 percent of this same landscape was at risk of displacement by juniper expansion. The encroachment problem is likely exacerbated by adjacent land uses and cheatgrass invasions that have decreased the habitat values in nearby, lower elevation big sagebrush communities, thereby increasing the importance of remaining habitats. Thus it may be important to consider surrounding land use when prioritizing habitats for treatment to insure that the net result is more usable (for example, accessible to local populations) sage-grouse habitat across the local and regional landscape. Further, whereas juniper may have negative implications for sage-grouse habitat quality, these areas can provide important winter range for ungulates (Anderson and others, 2012) indicating potential interactions among multiple species and habitat functions at the sagebrush-forest ecotone. These locations can be mapped with reasonable accuracy; therefore, encroachment within priority habitats may be specifically targeted. Regional modeling efforts suggested that locations within 3280 ft (1,000 m) of current pinyon-juniper woodlands have the greatest (20 percent) juniper-expansion risk and locations beyond this distance, 3280 to 6550 ft (1,000–2,000 m), experience one-half of this potential (Bradley, 2010). Based on a simple proximity modeling approach, whereby sagebrush habitats in close proximity (820 ft [250 m]) to an existing conifer woodland (especially juniper and pinyon pine, but also ponderosa pine and Douglas-fir) are recognized as having increased invasion risk due to proximity of the seed source, we estimate that 6 to 13 percent of sage-grouse habitat within all MZs may be at risk of conifer expansion. The most pronounced risks are, again, across the Great Basin where an estimated 13 percent (both PPH and PGH; southern Great Basin) and 10 to 12 percent (PGH and PPH, respectively; northern Great Basin) are predicted to be at risk (table 21, fig. 27*B*). Though substantial, the estimated risks in the Snake River Plain (7 to 8 percent PPH and PGH, respectively) and Wyoming Basin (6 to 7 percent PPH and PGH, respectively) are perceived to be smaller (that is, less area projected to be affected). Importantly, the acreage of predicted woodland expansion is one-half of the area projected for cheatgrass risk, and not all of these areas will be invaded uniformly or completely. In addition, acreage projected to be a “high fire risk” is 2 to 10 times greater (depending on MZ) than the area of projected conifer expansion. Although the precise probability and realization of woodland expansion will likely vary (from these model results) within zones identified, based on local environmental conditions, for example, this risk assessment identified large portions of sage-grouse habitat in MZs III, IV, and V as at risk of tree invasion based on proximity to seed sources (table 21) making this a potentially important consideration for managing habitats in those regions.

Prescribed fire is often used as an affordable and seminatural means to control woody invasion and restore invaded communities (Pyke, 2011). However, it is not clear that prescribed fire is the best management option in many cases (Rhodes and others, 2010). The best results reported were attained using manual treatments that retained cover of woody and herbaceous litter post-treatment (Baughman and others, 2010). A review of the impacts of treatments and grazing on grouse (Beck and Mitchell, 2000) suggested that fire be applied cautiously because optimal patterns of burned-unburned habitat and the ideal size(s) for burned patches are unknown, suggesting that small treatment areas coupled with monitoring of subsequent habitat and use patterns may improve restoration success. Research focused on treatment effectiveness (Brockway and others, 2002) indicated that mechanical tree thinning increased native understory biomass by 200 percent; typically, this type of response represents improvement of sage-grouse habitat. Additionally, mechanical operations followed by seeding have been used successfully to restore shrub- and tree-dominant states, however these are typically the most expensive management actions (Provencher and others, 2007). Previous efforts indicate that the success of native plant recovery increases with less pinyon and juniper cover and increases with improved condition of the pre-treatment community (Pyke, 2011). Gradients of condition and potential, estimated locally and applied during the planning process, coupled with local habitat and restoration priorities, may be a useful combination for guiding specific actions (see Section III. A11. Habitat Treatment and Vegetation Management).

A9. Grazing

The effect of livestock grazing on range condition is one of the most contentious issues underlying the management and use of sagebrush habitats (Crawford and others, 2004). [redacted] Although isolated areas exist that have not been grazed by domestic livestock (for example, the kipukas in the Great Rift lava fields of southern Idaho), most sagebrush habitats have been grazed in the past century (Knick and Connelly, 2011b). Livestock grazing has been described as a diffuse form of biotic disturbance that exerts repeated pressure over many years on a system; unlike point-sources of disturbance (for example, fires that have acute perturbations from well-defined origins), [redacted] (Knick and Connelly, 2011b). Thus, effects of grazing are not likely to be detected as disruptions—except in extreme cases as around water sources or mineral-nutrient blocks—but rather as differences in the processes and functioning of the sagebrush system (Knick and Connelly, 2011b). Importantly, effects of grazing are not distributed evenly, because historic practices, management plans and agreements, and animal behavior all dictate differential use and therefore different effects.

Historically, the numbers of livestock and the area grazed increased between 1880 to 1905 and combined with the drought that followed in the 1920s and 1930s severely altered the condition of western landscapes (Connelly and others, 2004). Numbers of livestock increased from 4.1 million cattle and 4.8 million sheep in 1870 to 19.6 million cattle and 25.1 million sheep in 1900 (Knick and Connelly, 2011b)[redacted]

Table 21. Summary of spatial model describing pinyon pine, juniper, and other conifer encroachment risk* across Management Zones by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)
MZ I–GP	**11,636,400**	**130,600**	**1.12**		**34,663,000**	**894,500**	**2.58**	
BLM	2,994,300	33,100	1.11	25	4,524,900	180,800	4.00	20
MZ II and VII–WB & CP	292,400	1,100	0.38	1	515,300	20,300	3.94	2
BLM	219,700	1,700	0.77	1	2,427,700	25,400	1.05	3
MZ III–SGB	7,132,500	82,800	1.16	63	24,682,800	604,800	2.45	68
BLM	995,600	12,000	1.21	9	2,498,400	63,100	2.53	7
MZ IV – SRP	1,900	0	0.00	0	13,900	0	0.00	0
MZ II and VII–WB & CP	**17,476,000**	**1,076,300**	**6.16**		**19,200,200**	**1,390,500**	**7.24**	
BLM	9,021,200	499,700	5.54	46	9,012,500	595,500	6.61	43
Forest Service	162,000	18,200	11.23	2	452,500	62,300	13.77	4
Tribal and Other Federal	784,000	77,100	9.83	7	1,354,600	88,400	6.53	6
Private	6,233,900	373,000	5.98	35	7,394,800	545,800	7.38	39
State	1,244,800	106,600	8.56	10	979,800	97,800	9.98	7
Other	30,100	1,700	5.65	0	6,000	700	11.67	0
MZ III–SGB	**10,028,500**	**1,292,400**	**12.89**		**3,970,100**	**517,400**	**13.03**	
BLM	6,309,400	751,400	11.91	58	3,199,800	394,000	12.31	76
Forest Service	1,236,200	247,000	19.98	19	356,200	86,800	24.37	17
Tribal and Other Federal	260,800	29,400	11.27	2	29,100	4,600	15.81	1
Private	1,836,200	217,400	11.84	17	384,800	32,000	8.32	6
State	385,900	47,100	12.21	4	200	0	0.00	0
MZ IV–SRP	**21,930,600**	**1,698,500**	**7.74**		**10,958,500**	**918,100**	**8.38**	
BLM	13,710,700	938,700	6.85	55	4,928,200	311,300	6.32	34
Forest Service	1,613,800	248,200	15.38	15	1,113,500	228,100	20.48	25
Tribal and Other Federal	633,600	10,000	1.58	1	522,500	11,100	2.12	1
Private	4,890,200	427,500	8.74	25	3,516,742	295,200	8.39	32
State	1,019,373	67,700	6.64	4	846,200	69,600	8.23	8
Other	62,900	6,400	10.17	0	31,400	2,900	9.24	0

Table 21. Summary of spatial model describing pinyon pine, juniper, and other conifer encroachment risk* across Management Zones by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)
MZ V–NGB	**7,097,200**	**823,500**	**11.60**		**5,808,000**	**533,700**	**9.19**	
BLM	5,117,500	597,500	11.68	73	4,196,700	346,600	8.26	65
Forest Service	62,200	11,300	18.17	1	114,900	29,200	25.41	5
Tribal and Other Federal	717,100	44,000	6.14	5	101,800	8,100	7.96	2
Private	798,000	106,800	13.38	13	1,199,000	132,300	11.03	25
State	64,900	2,700	4.16	0	115,800	7,300	6.30	1
Other	337,500	61,200	18.13	7	79,800	10,100	12.66	2

*Data Source: Modeled from National GAP/ReGAP Landcover, National GAP Analysis Program, 2010. Based on occurrence of sagebrush within 120 m of a conifer vegetation type.

[1]For management entities within a management zone calculated as the percent of the total direct impact in the Management Zone represented by that management entity, that is, the relative area of direct influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

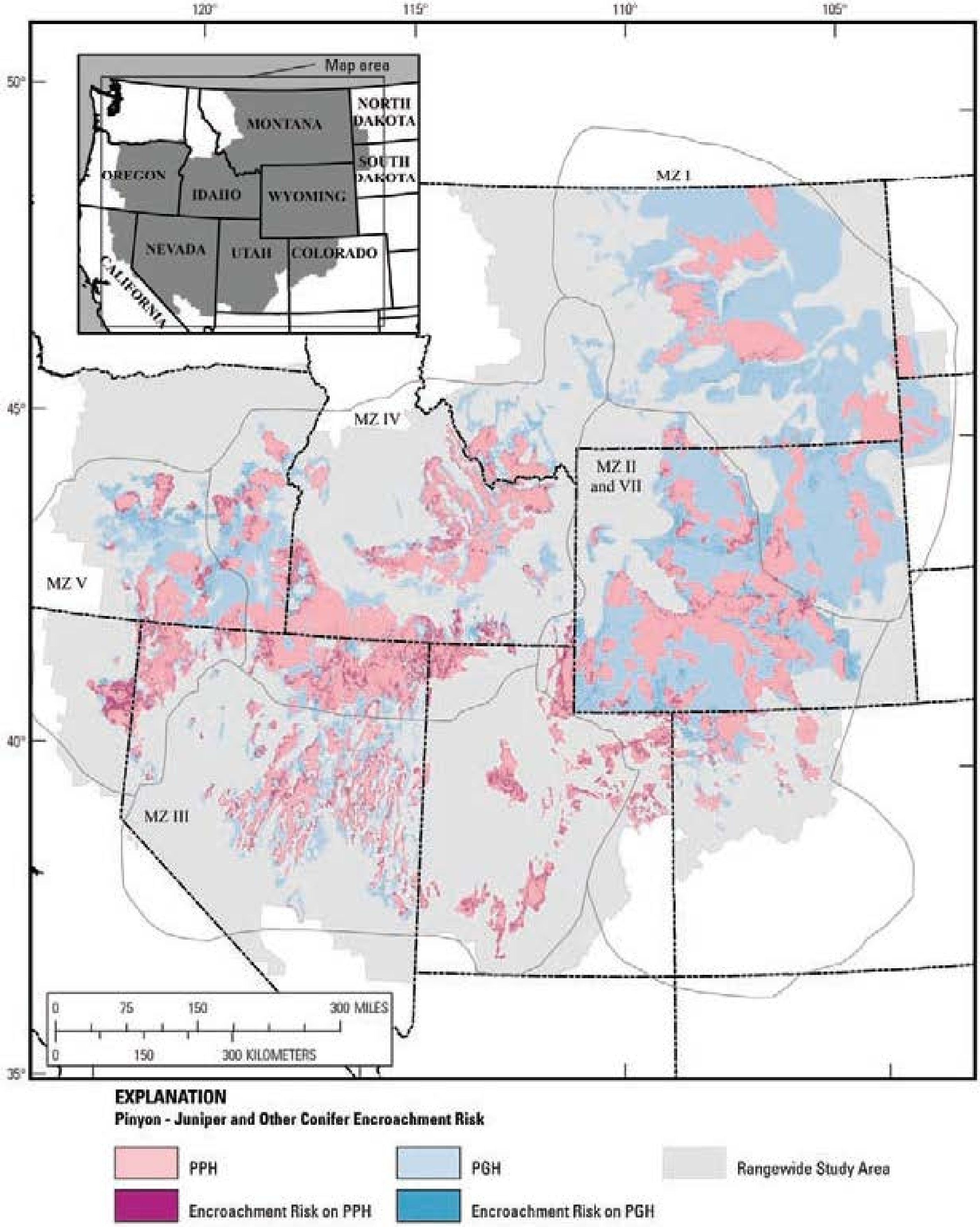

Figure 27*B*. Overlap of pinyon pine, juniper, and other conifer encroachment risk and preliminary priority and preliminary general habitats (PPH and PGH, respectively) in Management Zones (MZ) III, IV, and V (Great Basin).

grazing pressure were depleted from the vegetative community and replaced in much of the Great Basin, Snake River Plain, and surrounding intermountain regions by grazing-tolerant grass species, exotic annual grasses, or both. [redacted] Research revealed that the decline of palatable forage species and increases in plant species of low palatability took only 10 to 15 years at any given site under heavy uncontrolled grazing (Knick and Connelly, 2011b). [redacted] Implied in this estimate is the assumed relation that [redacted] years after severe overgrazing and droughts of the early 1900s ended. Current-use patterns vary based on local and regional plans and conditions, and grazing allotments and pastures on public lands (management units) represent the typical planning, leasing, and evaluation units used in grazing management across sage-grouse range. Grazing, assessed using Field Office records of grazing allotments, suggested that allotments “not meeting wildlife land health standards due to livestock grazing” influence sage-grouse habitats throughout MZ IV and western portions of MZ III, although BLM lands not meeting wildlife land health standards (due to livestock) can be found throughout the range of sage-grouse (table 22, fig. 28). Importantly, assessments for some lands were not available (some Federal and all State, private, and tribal lands), and conditions have changed since the data were gathered (assembled in 2008 using available data), so regional-scale comparisons may be misleading (contemporary, local data should supersede this information in most cases). [redacted]

Livestock grazing can affect soils, vegetation, water, and nutrient availability by consuming or altering vegetation, redistributing nutrients and plant seeds, trampling soils and vegetation, and disrupting microbiotic crusts (Connelly and others, 2004) [redacted], Knick and others, 2011). Ultimately, livestock function as keystone species; domestic grazing does not preclude native wildlife and vegetation, but it influences ecological pathways and can influence which plant and animal species persist (Knick and others, 2011). [redacted] Prolonged selective pressure can affect condition of individual plants, abundance of species, inter-specific competition, and ultimately, community composition (Miller and others, 1994; Beck and Mitchell, 2000; Wisdom and others, 2002; Erichsen-Arychuk and others, 2002; Holechek and others, 2003; Connelly and others, 2004; and Pyke, 2011). Although specific effects and conditions are localized in most cases, the cumulative effect of these transitions across the species’ range may affect the regional condition of sage-grouse habitats.

There is little scientific data directly linking grazing practices to sage-grouse population levels (Knick and others, 2011). Direct positive and negative effects of livestock grazing on sage-grouse reported in the literature include (1) light to moderate rest-rotation cattle grazing in mesic upland meadows promoted forb growth and availability and sage-grouse use, (2) sage-grouse used sheep salting grounds as leks, (3) heavy grazing in wet meadows deteriorated hydrology and reduced the extent of habitats suitable for summer—these sites were avoided by sage-grouse, and (4) [redacted]). To help make the connection between the effects of livestock grazing on plant community dynamics in sagebrush ecosystems, the context of state and transition theory (states being discrete, observable communities or conditions, and transitions represent the influence of drivers of change that move the community among alternative states) has been used to describe the observed range of variation of plant communities (Pyke, 2011) and frame a discussion of grazing effects on vegetation and habitat conditions, habitat treatments, wild horse and burro herds, and water developments. Though differences in tolerance and resilience may exist among different communities within the sagebrush ecosystem (for example, eastern versus western, northern versus southern), [redacted] Beck and Mitchell, 2000; Erichsen-Arychuk and others, 2002; Holechek and others, 2003; Connelly and others, 2004; Pyke, 2011).

Sage-grouse population persistence has been linked to the availability and condition of sagebrush habitat; the dependence of the species on sagebrush through all seasonal periods has been well documented and cannot be overemphasized (Connelly and others, 2004) [redacted]

Table 22. Summary of grazing allotments not meeting Land Health Standards for wildlife habitat with grazing as the causal factor* by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Management Zone Entity	PPH			PGH		
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)
MZ I–GP						
BLM	2,994,300	82,500	2.76	4,524,900	52,100	1.15
MZ II and VII–WB & CP						
BLM	9,021,200	286,900	3.18	9,012,500	366,000	4.06
MZ III–SGB						
BLM	6,309,400	965,400	15.30	3,199,800	654,600	20.46
MZ IV – SRP						
BLM	13,710,700	2,617,200	19.09	4,928,200	968,900	19.66
MZ V–NGB						
BLM	5,117,500	417,000	8.15	4,196,700	158,700	3.78

*Data Source: (Veblen and others, 2011; Assal and others, 2012). Only BLM-managed portions of allotments were evaluated. Data assembled in 2008 from available records.

increases the probability of a successful hatch. [redacted]

Grazing intensity—including stocking rate, duration, and frequency—has consistently been identified as having impacts on ecosystem and rangeland health (Vallentine, 1990; Briske and others, 2008; Veblen and others, 2011) including the structure required by sage-grouse. Similarly, the timing of grazing relative to plant phenology in particular can influence the sustainability of grazing (Briske and Hendrickson, 1998; Briske and others, 2003; Veblen and others, 2011) and compatibility with wildlife requirements. [redacted]) improving range conditions and habitat. Repeated grazing during this time tends to favor sagebrush growth (Pyke, 2011) through reduced competitive ability of grasses. Seasonal monitoring of range conditions could enable removal of livestock when stubble heights required to protect nests and broods are reached; however, this information is difficult to attain accurately in a timely way across large regions; therefore, surrogate measures or indices of condition would likely benefit this effort.

[redacted], 1997; Beck and Mitchell, 2000). [redacted]. 2000). [redacted] (Beck and Mitchell, 2000) and may [redacted] (Wright, 1970; Owens and Norton, 1990; Angell, 1997; Beck and Mitchell, 2000) suggesting an opportunity for adaptation of grazing systems to graze winter habitats in spring when brood-rearing habitats would be avoided, and vice versa.

A study (Van Poolen and Lacey, 1979), compiling results from 18 western grazing-system studies reported that adjustments in livestock numbers resulted in increased herbage production of approximately 35 percent and 28 percent when grazing-use levels were reduced from heavy (60–80 percent) to moderate (40–60 percent) and from moderate to light (20–40 percent), respectively. [redacted] a key habitat feature associated with hatching success of sage-grouse nests and chick survival during early brood-rearing. In contrast, others found season of use to influence production: grazing heavily during the spring or during spring and fall was detrimental to herbaceous understories (Mueggler, 1950; Laycock, 1978; Owens and Norton, 1990) [redacted]); thus, spring or spring-fall grazing could negatively impact nesting sage-grouse and young chick survival during early brood-rearing, and avoidance through rotation or rest may benefit nesting or brood-rearing success. Grazing during the fall had minor effects on herbaceous understories (Mueggler,

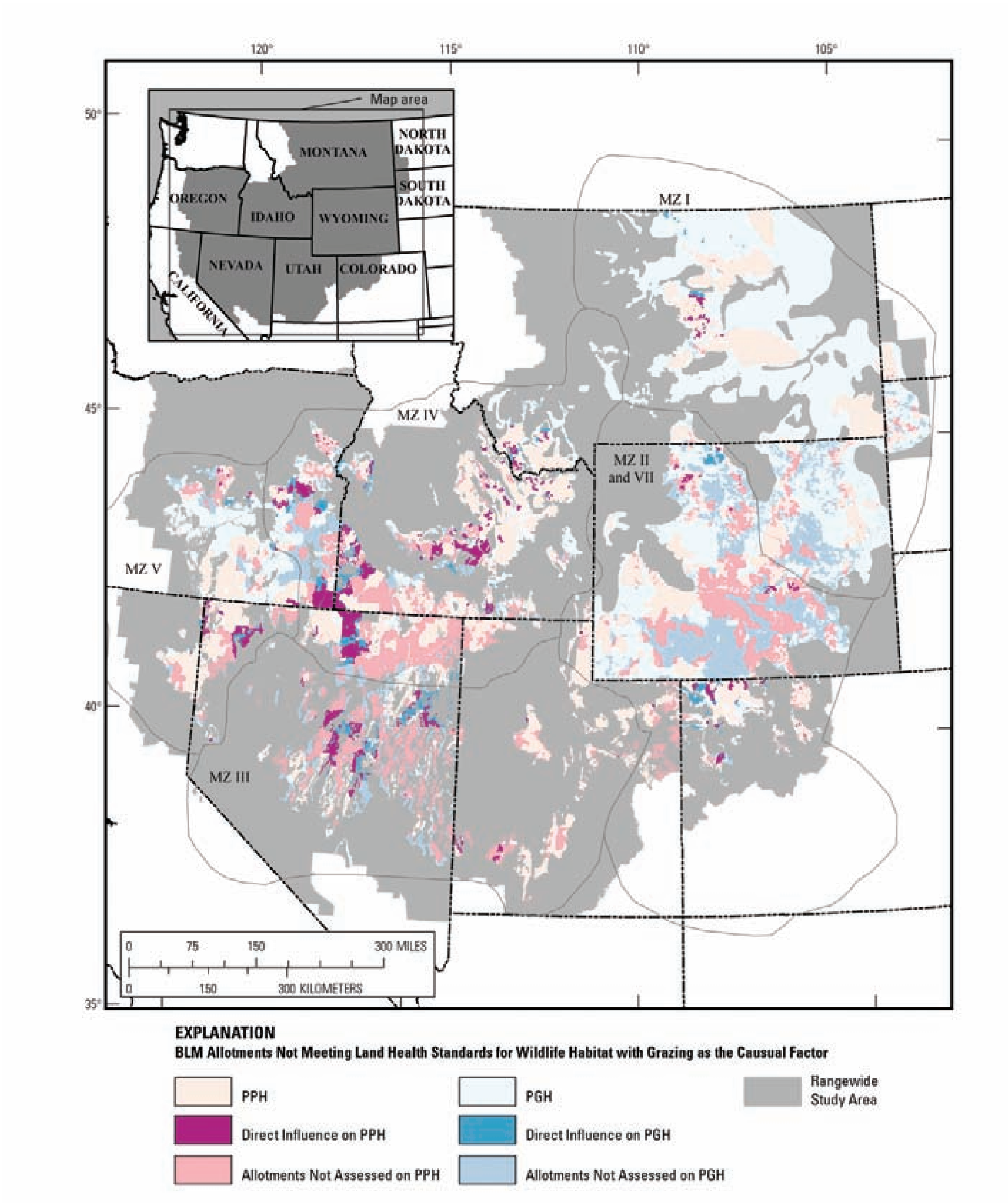

Figure 28. Overlap of grazing allotments not meeting Land Health Standards for wildlife habitat with grazing as the causal factor and preliminary priority and preliminary general habitats (PPH and PGH, respectively). Bureau of Land Management (BLM) lands only, assembled in 2008. MZ, Management Zone.

1950; Laycock, 1978; Owens and Norton, 1990). [redacted]

[redacted]4). Grazing system (based on rotation period) was less important relative to stocking rates and season of use in this study. [redacted] Comparing [redacted]). In contrast, no increases in total herbaceous standing crop after removal of livestock for 13 years were reported in Utah (Beck and Mitchell, 2000). Studies tracking changes in vegetation after removal of livestock in sagebrush systems report that initial proportions of the different growth forms were retained, [redacted], 2011). Thus, well-prescribed livestock management may positively influence sage-grouse habitat suitability especially during nesting (spring), early brood-rearing (early summer), and winter, [redacted]

Livestock distribution patterns are directly linked with water availability, and this bias has also had relevant, measureable impacts to riparian habitats, which are of primary importance for sage-grouse as late brood-rearing and summer habitats [redacted] High stocking rates in areas with limited water availability were particularly detrimental to forage productivity on lands immediately surrounding water sources (Hall and Bryant, 1995; Dobkin and others, 1998). [redacted]). However, [redacted]

[redacted]

Most sagebrush grasslands are in winter-dominated precipitation regions, and cool-season plants generally dominate the herbaceous layers (Pyke, 2011). Exceptions are the Colorado Plateau in southern Utah, eastern Utah, northeastern Colorado, eastern Wyoming, and eastern Montana (eastern portions of both MZ I and MZ III) where monsoon moisture creates a second peak of predictable moisture in late summer; warm-season plants co-dominate with cool-season plants in the herbaceous layers of these regions (Pyke, 2011). Therefore, the most significant long-term influence of grazing on sage-grouse habitat is the potential for transition from an ecological state dominated by sagebrush and early (cool) season grasses to a site dominated by sagebrush, grazing-tolerant grasses (increasers), invasive annual grasses and forbs, or woodlands (Pyke, 2011) driven by persistent, selective herbivory that can affect composition, dominance, and community structure (Manier and Hobbs, 2007). Importantly, not all sagebrush communities are identical. Sagebrush-steppe is one of the most widespread and characteristic vegetation types in the intermountain west, and it comprises the northern portion of the sage-grouse distribution (West, 1988). In these communities, co-dominance of perennial bunchgrasses along with one or more of the 12 different species of sagebrush creates a variety of types and conditions that supported moderate species diversity and historically some limited populations of large herbivores (West, 1988). On eastern portions of the species' range, where the sagebrush-steppe gradates with mixed-grass prairie species, rhizomatous grasses often play a prominent role in community composition with important implications for grazing management (especially in MZ I). Great Basin sagebrush characterizes sagebrush communities in the southern and southwestern portions of the sage-grouse range (MZs III, IV, V, and VII) , and though there are similarities in composition and structure, these systems have significantly lower diversity, productivity, and resilience to disturbance owing to greater aridity across these regions (West, 1988). Thus, though the northern sagebrush-steppe has proven similar in response to disturbance and management to semiarid grasslands [redacted] Thus, it is probable that the impacts of overgrazing are more severe in these arid regions compared to northern wetter regions. Further impacts of drought and prolonged shifts in precipitation patterns may trigger shifts in systemic condition, productivity, and resilience in areas that were previously more robust, and this may cause significant differences in effects of local grazing practices.

[redacted] and others, 2005;

Holloran and others, 2005). With few exceptions, ensuring adequate residual herbaceous cover through the nesting season (through June in most areas) will provide for long-term resilience with plant communities that include healthy bunchgrass understories and adequate residual grass cover and height to support annual objectives (Pyke, 2011). [redacted] According to research conducted in sagebrush-steppe, [redacted] Conclusions from a review of the effects of herbivory on bluebunch wheatgrass (*Pseudoroegneria spicata*), an important sagebrush associate, indicated (1) utilization levels of 30 to 40 percent under deferred grazing systems is a recommended maximum use-level if maintaining the community is desirable; (2) [redacted] and (3) grazing following the growing season has little effect, although yield reductions the following year may occur if grazed to 2-inch stubble height (Anderson, 1991). Annual and seasonal monitoring of production and standing crop, with subsequent removal of livestock as range utilization reaches capacity (Holechek and others, 1989; Thurow and Taylor, 1999) is important for providing for habitat quality rangewide and would be facilitated by development within local monitoring, planning, and adaptive management cycles.

Even though livestock numbers have been considerably lower since the implementation of the Taylor Grazing Act in 1934, and grazing management across the West has steadily improved, acres continue to transition away from reference (historic, potential, and [or] desired) conditions (Cagney and others, 2010). Because of lasting historic impacts (late 1800s–early 1900s), the reduced numbers of livestock in the modern era often do not simply represent reduced grazing effects (Knick and others, 2011), [redacted] Importantly, environmental patterns, historic and current uses vary tremendously in space and time, and though some generalizations may be made, local conditions and appropriate solutions will be based on local understanding and adaptations. Thus in some areas, grazing on sage-grouse habitat may be a component of both long-term management to promote resilient, desirable plant communities and annual management of the standing crop to provide residual cover for sage-grouse (Cagney and others, 2010; Pyke, 2011). However, if the desired vegetative components are not present in a priority site, additional manipulations may be required such as addition of desired species through active restoration (Pyke, 2011), and because these treatments may be expensive, prioritization based on habitat value and site potential may be warranted.

Interactions between grazing and recent disturbances can have lasting effects on recovery of sage-grouse habitat values in the post-disturbance environment. Deferring grazing for two growing seasons after disturbance has been recommended because it allows the cool season bunchgrasses— [redacted] ce (Knick and others, 2011). However, reintroduction of livestock to a disturbed area prior to the native or reseeded plant community becoming established, regardless of the number of years of rest afforded the site, can result in failed rehabilitation efforts and increased levels of exotic grasses (Knick and others, 2011). Although rest is often prescribed, timing, intensity, and duration of grazing of treated rangelands may be more important than a specific period of rest after fire (Bates and others, 2009). Moderate grazing after perennial grass dormancy (that is, late season) in the first two summers after fire is not likely to reduce the recovery ability of herbaceous communities in sagebrush-steppe (Bates and others, 2009) when rest during the growing season is permitted. Differences in herbaceous cover among burn-ungrazed and burn-grazed areas were not observed during the first 6 years after fire, but between 7 and [redacted] so long-term post-treatment monitoring may be important. Treated areas may draw grazing pressure from all herbivores; thus, treatment designs that consider the possibility of an unplanned escalation of use by wild horses or elk (Cagney and others, 2010) when significant populations of these species are present have better chances of meeting productivity and habitat targets.

Wild Horses

Free-roaming horses (*Equus caballus*) and burros (*E. asinus*) have been a component in the dynamics of sagebrush and other semiarid communities since they were brought to North America at the end of the 16th century (Connelly and others, 2004). Approximately 40,000 free-roaming horses currently live in ten Western U.S. States; areas managed for horses and (or) burros from 1971 to 2007 constitute approximately 18 percent of currently occupied sage-grouse range predominantly in Nevada, southwest Wyoming, and southeast Oregon (Connelly and others, 2004; Beever and Aldridge, 2011). Because of physiological differences, a horse consumes 20 to 65 percent more forage than would a cow of equivalent body mass (Connelly and others, 2004). Comparing horse-removed sites to horse-occupied sites, researchers have documented the following equid-induced changes to sagebrush communities: (1) reduced total vegetative and grass abundance and cover, (2) lower sagebrush canopy cover, (3) increased fragmentation of shrub canopies, (4) lower species richness, (5) increased compaction in surface soil horizons (Bartmann and others, 1987), and (6) increased dominance of unpalatable forbs (Beever and Aldridge, 2011). Additionally, because horses separate themselves from cattle by using higher elevations and steeper slopes, horse occupancy of a sagebrush ecosystem reduces the occurrence of ungrazed areas (Connelly and others, 2004). Areas managed Federally as wild horse and burro range constitute approximately 14.6 million acres (5.9 million hectares; 10.24 percent) of sage-grouse habitats across the range of the species (table 23, fig. 29*A*). Wild horse and burrow range coincides with sage-grouse habitat predominantly in Nevada, southwest Wyoming, and southeast Oregon; in these MZs (III and V and II and VII), 19.9 percent of priority habitats are negatively influenced.

Water Developments

Open water has been suggested as a limiting factor for summering sage-grouse. Although water availability may influence the species' summer distribution (Patterson, 1952; Autrienth, 1981), movements to summer range are probably in response to lack of succulent forbs in an area rather than a lack of free water (Connelly and Doughty, 1989). Existing research suggests that sage-grouse do *not* regularly use water developments even during relatively dry years but obtain required moisture from consuming succulent vegetation in the vicinity (Connelly, 1982; Connelly and Doughty, 1989; Connelly and others, 2004). More than 56,500 water development projects have been implemented on lands managed by the BLM within the current distribution of sage-grouse plus a 50 km (31 mi) buffer around this distribution (Connelly and others, 2004; fig. 29*B*). Water developments are generally intended to provide water for livestock or wildlife but may also be designed to provide succulent vegetation surrounding the water.

Artificial water sources may facilitate the spread of West Nile virus (WNv) within sage-grouse habitats because these water developments support abundant populations of the mosquito (*Culex tarsalis*) longer than natural, ephemeral water sources thereby providing habitat for the vector responsible for the majority of WNv infections (Walker and Naugle, 2011). Additionally, projects that create mesic zones around water developments to promote the growth of succulent vegetation may inadvertently contribute to the proliferation of WNv as *Culex tarsalis* regularly breed in water-filled hoofprints in these areas (Walker and Naugle, 2011). Water developments tend to attract other animals and thus may serve as predator sinks for sage-grouse (Connelly and Doughty, 1989). Additionally, water developments have substantially influenced the movements and distribution of livestock in arid western habitats and have increased the amount of sagebrush area available for livestock (Connelly and others, 2004), which—although these practices may benefit riparian conditions (sage-grouse summer habitats)—may increase the effect of livestock across the landscape, expanding impacts to upland areas important for sage-grouse during nesting, early brood-rearing, and winter seasons.

A10. Climate Dynamics

Climate change is a complex process in which interactions among natural and anthropogenic drivers affect atmospheric characteristics leading to long-term changes in temperature and precipitation (IPCC, 2007; Miller and others, 2011). Notably, the climate has always been understood as a highly dynamic system, and although it has been possible to develop understanding and theories using persistent patterns (in space and time), the climate has always been changing. Modern issues and concerns over climate change are generally focused on rapid warming and associated circulation feedbacks that have been linked to human industrial activities. Although imprecise, plausible global climate change models predict higher temperatures, drier soils in summer with high variability, severe weather events (drought and storms), and changing moisture regimes across mid-latitude, semiarid regions of the American West (Finch, 2012; Friggens and others, 2012).

Sage-grouse population dynamics were strongly related to multiple climatic conditions as measured between 2003 and 2010 in central Nevada (Blomberg and others, 2012). Precipitation (annual rainfall, annual precipitation, and average winter snow depth) was positively related to annual recruitment (higher recruitment in years with high precipitation); the positive relation was strongest with total annual rainfall. Additionally, annual rainfall and mean monthly winter snowpack were positively related to sage-grouse population growth. Annual adult male survival was negatively related to maximum summertime temperatures (high survival in years with low maximum temperature). Results from this study suggest a direct link between sage-grouse population dynamics and several ecological processes expected to be influenced by climate change in southern portions of the species' range (for example, decreased precipitation amounts and increased temperatures); projected changes to climate are likely to negatively influence sage-grouse population dynamics if they decrease the productivity of the sagebrush ecosystem (Blomberg and others, 2012).

Changing climate conditions may render some locations less suitable for sagebrush than for other species, creating potential shifts in ecosystem distributions (Bradley, 2010). Increased temperatures, the trend for decreased snowpack, earlier onset and warmer spring periods, and reduced summer water flows in the Western United States could exert stresses on sagebrush; sagebrush seedling recruitment may be particularly susceptible to these changes in climate (Miller and others, 2011). A substantial increase in temperature could impart a competitive advantage to woodland vegetation currently dominating the Chihuahuan and Sonoran Deserts, and these woodlands may expand northward and displace large areas of sagebrush (Miller and others, 2011). Increased levels of carbon dioxide may favor exotic annual grasses; in controlled laboratory tests, reproductive biomass of cheatgrass doubled and time to maturation decreased at elevated levels of carbon dioxide (Miller and others, 2011). Under current atmospheric carbon dioxide levels, cheatgrass competes successfully against native grasses because of earlier maturation, shallow root systems preempting water in soils, greater seed production, and the ability to respond quickly to disturbance (Miller and others, 2011). Thus, plausible scenarios suggest that an

Table 23. Summary of Federally managed Wild Horse and Burro Herd Management Areas and Territories* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)
MZ I–GP	**11,636,400**	**0**	**0.00**		**34,663,000**	**0**	**0**	
MZ II and VII–WB & CP	**17,476,000**	**2,217,100**	**12.69**		**19,200,200**	**2,734,700**	**14.24**	
BLM	9,021,200	1,792,900	19.87	81	9,012,500	2,007,200	22.27	73
Forest Service	162,000	0	0.00	0	452,500	0	0.00	0
Tribal and Other Federal	784,000	69,800	8.90	3	1,354,600	50,700	3.74	2
Private	6,233,900	271,200	4.35	12	7,394,800	602,400	8.15	22
State	1,244,800	83,200	6.68	4	979,800	74,300	7.58	3
Other	30,100	0	0.00	0	6,000	0	0.00	0
MZ III–SGB	**10,028,500**	**2,479,800**	**24.73**		**3,970,100**	**1,635,800**	**41.20**	
BLM	6,309,400	2,199,200	34.86	89	3,199,800	1,463,200	45.73	89
Forest Service	1,236,200	210,100	17.00	8	356,200	136,100	38.21	8
Tribal and Other Federal	260,800	11,700	4.49	0	29,100	14,700	50.52	1
Private	1,836,200	44,500	2.42	2	384,800	21,800	5.67	1
State	385,900	14,300	3.71	1	200	0	0.00	0
MZ IV–SRP	**21,930,600**	**1,244,200**	**5.67**		**10,958,500**	**642,600**	**5.86**	
BLM	13,710,700	1,177,200	8.59	95	4,928,200	601,400	12.20	94
Forest Service	1,613,800	0	0.00	0	1,113,500	0	0.00	0
Tribal and Other Federal	633,600	0	0.00	0	522,500	7,200	1.38	1
Private	4,890,200	51,900	1.06	4	3,516,742	29,100	0.83	5
State	1,019,373	15,000	1.47	1	846,200	4,800	0.57	1
Other	62,900	0	0.00	0	31,400	0	0.00	0

Table 23. Summary of Federally managed Wild Horse and Burro Herd Management Areas and Territories* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).—Continued

Abbreviations: SG, sage-grouse; GP, Northern Great Plains, WB, Wyoming Basin; CP, Colorado Plateau; SGB, Southern Great Basin; SRP, Snake River Plain; NGB, Northern Great Basin.

Management Zone Entity	PPH				PGH			
	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)	SG Habitat (acres)	Direct Footprint (acres)	Direct Footprint (%)	Relative Influence[1] (%)
MZ V–NGB	**7,097,200**	**2,190,000**	**30.86**		**5,808,000**	**1,476,300**	**25.42**	
BLM	5,117,500	2,002,900	39.14	91	4,196,700	1,399,600	33.35	95
Forest Service	62,200	0	0.00	0	114,900	0	0.00	0
Tribal and Other Federal	717,100	4,300	0.60	0	101,800	700	0.69	0
Private	798,000	73,400	9.20	3	1,199,000	75,000	6.26	5
State	64,900	5,600	8.63	0	115,800	400	0.35	0
Other	337,500	103,800	30.76	5	79,800	600	0.75	0

*Data Source: BLM (2012), USFS Enterprise Data Warehouse, 2012. Nonfederal lands fall within these areas and the presence of wild horses and burros on those lands is dependent on local management practices, such as, fencing or tolerance of trespass.

[1]For management entities within a Management Zone, these were calculated as the percent of the total direct impact in the Management Zone represented by that management entity, that is, the relative area of direct influence among management entities. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

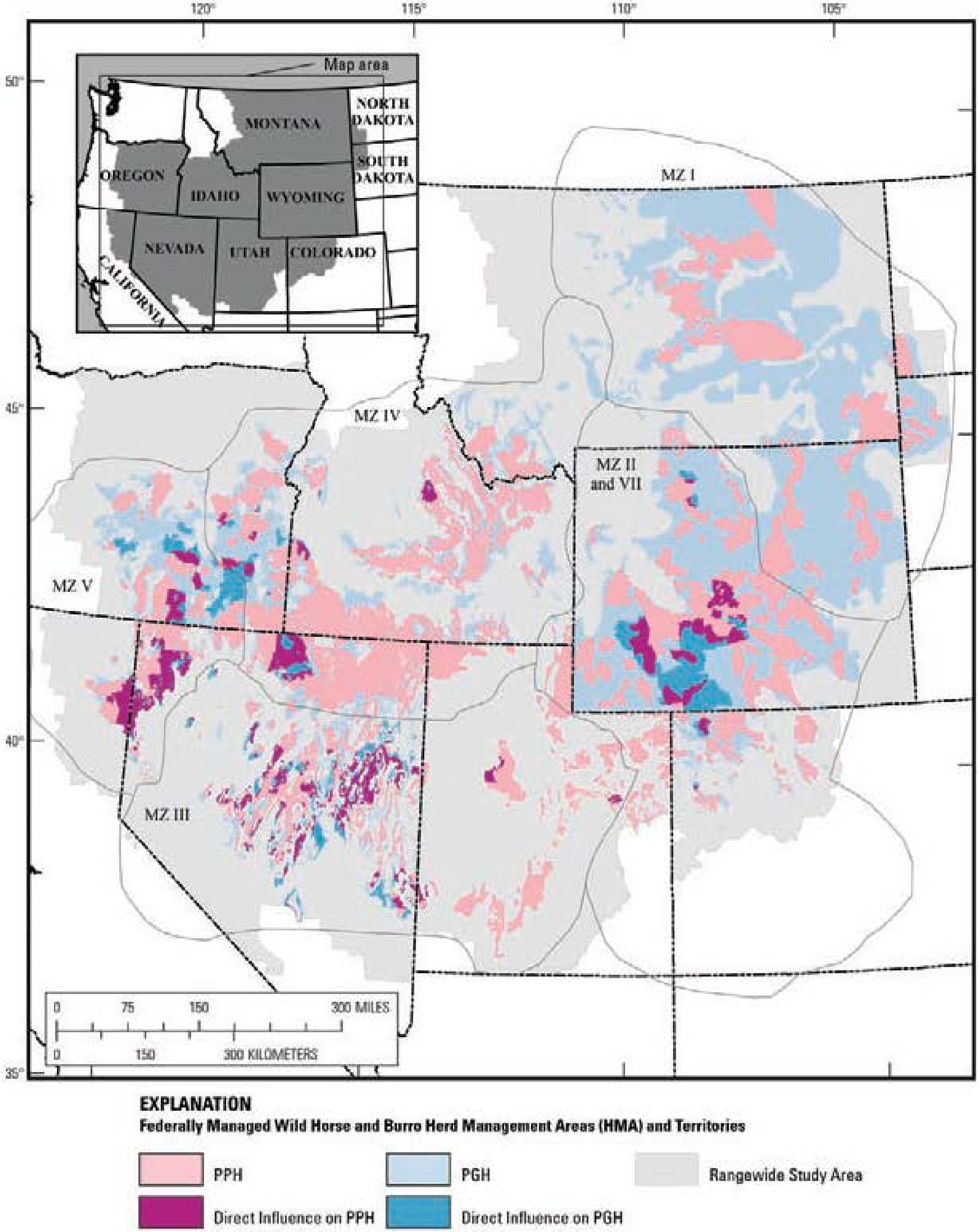

Figure 29*A*. Overlap of Federally managed Wild Horse and Burro Herd Management Areas and Territories and sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively) within each Management Zone (MZ).

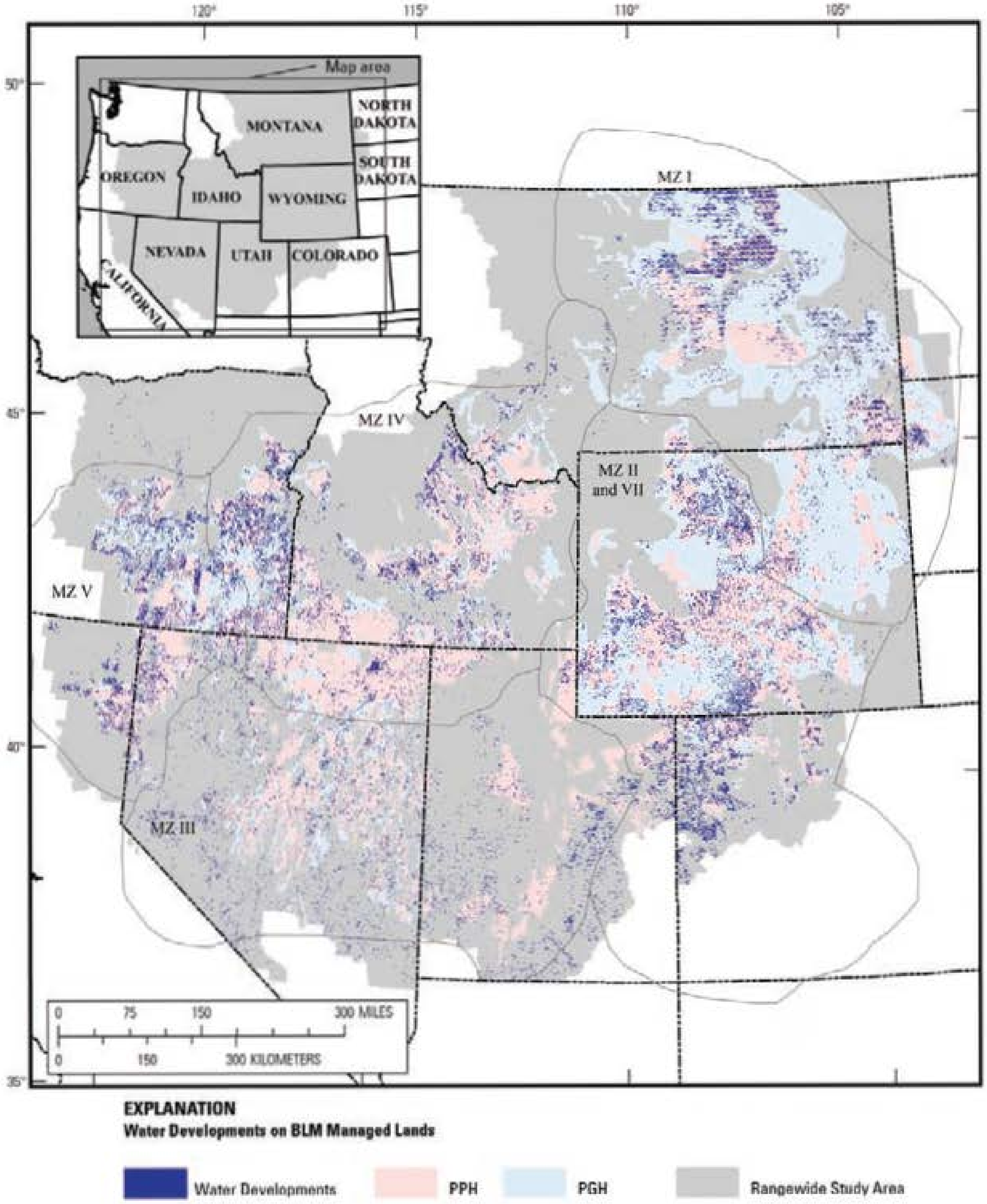

Figure 29*B*. Distribution of water developments on Bureau of Land Management lands overlapping sage-grouse preliminary priority and preliminary general habitats (PPH and PGH, respectively) across each Management Zone (MZ).

increase in the competitive advantage of cheatgrass may facilitate the species' spread, exacerbating the cycle of fire and cheatgrass-dominance already eliminating substantial acreages of sagebrush annually (Miller and others, 2011).

In central Nevada, recruitment of male sage-grouse to leks was consistently low in areas with substantial exotic grasslands interspersed in the landscape surrounding a lek, even during years when climatic conditions resulted in substantial recruitment to leks in the region (Blomberg and others, 2012). The interactive relation between climate and exotic annuals suggests that pulses in the growth of a sage-grouse population in response to increased precipitation may be mediated by the presence of areas dominated by exotic annuals within key habitats (Blomberg and others, 2012). Therefore, changing precipitation patterns and competitive advantages cheatgrass has over native vegetation, such as rapid response to moisture availability, may act synergistically to negatively affect sagebrush ecosystem condition and associated sage-grouse population dynamics.

Summer precipitation and temperature are the best predictors of sagebrush regional distribution suggesting that changing summer conditions may have the most impact on long-term viability of sagebrush habitats (Bradley, 2010). Climate change risk to sagebrush due to changing summer conditions may be most pronounced in southern portions of the species' range where decreased precipitation and (or) rising temperatures may make current habitat climatically unsuitable in the future (Bradley, 2010). However, in an experimental study where rainout shelters excluded natural rainfall and seasonal distribution of precipitation was controlled, Bates and others (2006) found that Wyoming big sagebrush (*Art. tri. wyomingensis*) did not respond in terms of cover or density to shifts in the timing of precipitation from predominantly winter (for example, normal precipitation timing on-site of 75 percent occurring between October and April) to spring (80 percent of total water applied between April and July) in the short term (7 years), suggesting changes to the shrub overstory may take decades to materialize. Additionally, increasing summer temperatures have been related to increases in threetip sagebrush (*Art. tripartita*) population growth, a result driven by increased survival of this species (Dalgleish, 2011).

The loss of approximately 12 percent of the current distribution of sagebrush was predicted to occur with each 1°C increase in temperature, primarily to increasing distributions of other woody vegetation (Miller and others, 2011). However, most scenarios do not factor in the potential response of exotic annual grasses and the consequences these changes may have on the distribution of sagebrush habitats; therefore, estimates of range contraction may be low. The current distribution of sagebrush is predicted to decline by 80 percent under one of the most extreme global climate change scenarios of an increase of 6.6 °C (Miller and others, 2011). A general geographic pattern of future sagebrush occurrence is characterized by substantial decreases in southern parts of the species' range combined with some increases in the northern parts; models also forecast small increases in distribution at higher elevations, for example, at the interface with coniferous forest (Schlaepfer and others, 2012). Forecasts additionally suggest that sagebrush ecosystems may split into several large but disjoint areas: Washington, Sierra Nevada area, Oregon- northern Nevada, central Idaho, an area encompassing eastern Utah, Wyoming, Colorado, and eastern Montana-Saskatchewan (Schlaepfer and others, 2012).

Decreased annual precipitation negatively influenced needle-and-thread (*Hespirostipa comata*) population growth in sagebrush habitats, primarily by reducing survival of this grass species (Dalgleish, 2011). Herbaceous plants were detrimentally affected by a shift in precipitation timing in sagebrush habitats from predominantly winter (75 percent of total water occurring between October and April) to spring (80 percent of total water applied between April and July) as indicated by a pattern of lower herbaceous biomass, cover, and densities compared to the other treatments (Bates and others, 2006).

Importantly, the potential effects of climate change on sagebrush and sage-grouse outlined above are not supported—nor are they falsified—by empirical data. Projecting the potential consequences of global climate change requires scientists to extend correlational and mechanistic relations beyond observed data leading to uncertainty in results. Despite limitations, the potential effects of climate change may be reasonably factored into long-term conservation actions through recognition of risks and possibilities, but predicted responses of species and habitats to long-term, imprecise forecasts are unlikely to provide accurate details regarding future conditions. Projections of sage-grouse population trends and extinction probabilities used for management of the species generally extend 100 years into the future (see Garton, 2011), and during this period the projected changes to the climate and the effects these changes may have on sagebrush habitats may become sufficiently large to overwhelm any current trajectory of habitat loss and alteration (Miller and others, 2011). The empirical data presented suggests that potential effects of global climate change (such as prolonged drought) may influence the herbaceous understory in sagebrush habitats before effects on the shrub overstory become apparent.

A11. Habitat Treatments and Vegetation Management

Given the historic reduction and conversion of the most productive communities within the sagebrush ecosystem, less than half of the original distribution of sagebrush ecosystems currently exists (Knick and Connelly, 2011b; Pyke, 2011) making conservation of existing sagebrush habitats a priority. Consideration of modern habitat treatments in the context of historic treatments and disturbances, which can affect the regional distribution and condition of sagebrush at multiple scales, may be useful for planning, maintenance, and restoration of priority sagebrush habitats (albeit with different emphases depending on local conditions). Historic habitat treatments often focused on removal or reduction of sagebrush in favor of improved herbaceous cover and productivity (Knick and others, 2011), whereas modern-era treatments have focused on fire control and fuel mitigation, noxious species control, and surface (soil) stabilization. Between 1929 and 2004, more than 6,000 land and vegetation treatments (burning, mowing, chaining, cabling, chipping, logging, chemical application, furrowing, ripping, tillage, pitting, terracing, checks, scalping, and seeding) were conducted on BLM lands in Colorado, Idaho, Montana, Nevada, Oregon, and Wyoming[1] (BLM Range Improvement Project database, Knick and others, 2011), which represents a large and coordinated effort to manipulate vegetation composition and structure, increase productivity, improve forage-browse quality, rejuvenate old growth, remove noxious or poisonous species, and manage structure and composition to protect buildings and manage fuels (Knick and others, 2011).

Although rangewide compilation of precise acreage and locations of historic treatments does not exist, recent estimates suggest more than 4,000 km^2 (988,400 acres) were treated within these States between 1997 and 2006 (617,750 acres [2,500 km^2] of prescribed burns; 346,000 acres [1,400 km^2] of mechanical fuel treatments; and 154,700 acres [626 km^2] of mechanical habitat treatments). This results in an estimate of more than 8.15 million acres (33,000 km^2) treated (approaching 12 percent of sage-grouse habitat area based on mean values and a data-limited estimate of a highly variable activity). Vegetation manipulations were more prominent during the post-war (WWII) era, circa 1940–60, making this extrapolation based on modern treatment areas a conservative estimate.

Accumulation of habitat treatments across a targeted landscape may outpace natural disturbance (Manier and others, 2005), suggesting that natural and anthropogenic disturbance history could be considered together for a comprehensive perspective on disturbance patterns and processes (capturing spatial and temporal dynamics) that influence sage-grouse habitats. Although treatments may have varied post-treatment effects, management treatments are typically designed to mimic natural processes, such as stimulating post-disturbance regeneration and (or) creating post-disturbance hazard levels (Baughman and others, 2010), without negative effects on public safety (for example, due to wildfire). Treated areas often have lasting effects that accumulate across the landscape and can affect resource use patterns for many years (Miller, 2008; Hess and Beck, 2012; Beck and others, 2012; Chong and Anderson, 2010). Comprehensive (accurate and inclusive) records for historic treatments have not been compiled or published at this time (making accurate assessment of historic effects impossible, currently); however, local planning and management efforts may incorporate this information when available. Importantly, due to perceived threat of wildfire and strong similarities in the detrimental effects of prescribed fire, mechanical and chemical treatments on habitat value for sage-grouse, "an immediate and potentially long-term result [of treatments in sagebrush habitats] is the loss of habitat" (U.S. Fish and Wildlife Service, 2010b).

Current treatments and active vegetation management typically focus on vegetation composition and structure for fuels management, habitat management, and (or) productivity manipulation for improving the habitat and forage conditions for ungulates and other grazers, for example thinning sagebrush cover or treating invasive plants (Knick and others, 2011). Locally and cumulatively across a region, the distribution of these treatments can affect the distribution of sage-grouse and sagebrush habitats by affecting the distribution of suitable cover and forage. Therefore, regional land-use plans that consider the distribution, composition, and condition of sage-grouse habitat (and potential for restoration), along with economic and planning criteria, may be able to improve habitat conditions using spatial patterns, habitat conditions, and treatment methods.

In addition to landscapes with large, intact patches of sagebrush, sage-grouse require high-quality habitat conditions including a diversity of herbaceous species, vegetative and reproductive health of native grasses, as well as an abundance of sagebrush, making management for high-condition in seasonally important habitats a priority; recent and ongoing management activities have sought to address these values making current activities relevant as they assist natural processes to recover from past disturbances. Residual vegetation cover, especially grass and litter, has often been noted as essential for concealment during nesting and brood-rearing (Sveum and others, 1998a; Sveum and others, 1998b; Kirol and others, 2012), suggesting opportunities to improve herbaceous cover (without sacrificing safety of sagebrush cover) may benefit fecundity. For example, adjusting timing and duration of livestock use to support quality conditions during seasonal use (that is, reduce or eliminate spring grazing in nesting and brood-rearing areas). Passive restoration is typically the most affordable approach to restoration treatment because it does not require directed human activities but rather depends on adjustments in processes and management structure that can be imparted through revised use strategies (Connelly and others, 2004, p.320). "The greatest land-use adjustment within the sage-grouse region that might bring about passive restoration is to change livestock management, largely because of the prevalence of livestock grazing as a land use" (Pyke, 2011, p. 537). A previous review of literature discussed positive *and* negative impacts of grazing on sage-grouse habitats (Beck and Mitchell, 2000) and indicated that simple modifications (such as removing livestock) may not have the desired consequences for habitat conditions (also see Section III. A9. Grazing). They suggested that treatments (prescribed fire, mechanical, and herbicide) that eradicate large areas of sagebrush be ceased but also indicated that thinning dense sagebrush down to

[1] Not all of these treatments were in sagebrush habitats (but we are unable to separate them at this time) so for these States these values may overestimate treatments in sagebrush; however, Calif., N. Dak., N. Mex., S. Dak., and Utah were excluded from this calculation as these States have lower ratio of sage to other types on BLM lands (for example, grasslands and woodlands); thus, we underestimate contribution to rangewide assessment by excluding these States leading to some balance in this index. These values are clearly not precise, but help provide context.

approximately 15-percent cover can support herbaceous production as well as provide sufficient cover for sage-grouse in Wyoming sagebrush communities (Beck and Mitchell, 2000). Patchy applications are better than large, homogeneous burns, but the most xeric sites should be avoided; herbicide treatments and seeding of native species will be effective in many areas (Beck and Mitchell, 2000). If historic alteration of the habitat has not been too severe, then adjusting management practices (the grazing system or seasonal recreation closures, for example) has a reasonable chance of improving degraded or altered habitat conditions (Connelly and others, 2004). Though individual activities do not typically alter landscape-scale habitat patterns, treatment areas and effects can accumulate with regional effects; revised treatment approaches that consider landscape distribution of habitat and disturbances can help insure a controlled, positive effect of treatments on sage-grouse populations.

Because local priorities may include improved connectivity or increased habitat area, active restoration treatments may be warranted if target areas have transitioned into new vegetation states or other degradation of the site has occurred (Pyke, 2011). Site degradation may be severe in some locations such that critical soil-surface horizons have been reduced or lost, or establishment of “undesirable” species has been sufficient to displace native species, requiring direct manipulation and making passive management approaches unsuitable (Connelly and others, 2004). For example, if invasive species (for example, cheatgrass) or native species (for example, junipers, pinyon pines, and rabbitbrush) have replaced desirable dominant species, as is common in parts of the Great Basin, Snake River Plain (MZs III and IV) and elsewhere, then active removal of the invaders and seedings of native species may be required for successful restoration (Connelly and others, 2004). Importantly, given the limited distribution of suitable sagebrush habitats and the cost of habitat restoration treatments, management plans that strategically protect intact sagebrush and restore impacted areas to enhance existing habitats (for example, connectivity of intact sagebrush) have the best chance of increasing the amount and quality of sagebrush cover and creating management flexibility in the future. Recognition of the relative condition and potential value of habitats can help determine options and priorities among regional and adjacent treatment areas and support considerations of cost, benefit, and risk. A treatment and restoration matrix represents a basic set of conditions and associated restoration options to guide scoping and preliminary planning steps (table 24). Further, distinction of well-directed, designed, and located treatments from historic treatments (with alternate goals but similar names) is useful for clarity in assessment and planning.

A12. Other Land Uses

Recreation

Dispersed recreation activities (including but not limited to off-highway vehicles, camping, bicycling, and hunting), which utilize the extensive network of official and unofficial roads, have an extensive and difficult-to-measure impact on sagebrush and sage-grouse (also see Section III. A4. Infrastructure). Potential impacts include noise (Blickley and others, 2012), distribution of invasive plants, (With, 2004; Christen and Matlack, 2009; Bradley, 2010; Huebner, 2010), generation of fugitive dust (Gillies and others, 2005; Lee and others, 2007; Ouren and others, 2007; Padgett and others, 2008), and effects on predator and prey behavior (Gavin and Komers, 2006; Poulin and Villard, 2011; Whittington and others, 2011). Uninhabited areas within the Great Basin ecoregion (MZs III and V) decreased 90 percent (22.2 million acres [90,000 km^2]) to less than 3 million acres (12,000 km^2) with expansion driven by economic and recreation opportunities in the region (Knick and others, 2011); similarly, population densities have increased 19 percent in the Wyoming Basin region (MZ II) and 31 percent on the Colorado Plateau (MZ VII) since 1920 (Knick and others, 2011). With expanding populations comes greater human impacts (Leu and others, 2008), which is magnified by popular access to public lands (Hansen and others, 2005) and dispersed uses that expand the human footprint. Impacts of roads and motorized trails include mortality due to collisions, behavior modifications due to noise, activity and habitat loss, alteration of the physical environment, leaching of nutrients, erosion, spread of invasive plants, and increased use and noise due to accessibility (Knick and others, 2011). Closing unused and unnecessary roads in and around sagebrush habitats (for example, seasonal closure of specified sage-grouse habitats) may reduce the footprint and associated impacts to wildlife. Restricting access to important habitat areas based on seasonal use and coincident with sage-grouse activities (for example, lekking, nesting, brood-rearing, and wintering) may decrease the impacts associated with humans but will not eliminate other impacts such as spread of invasive plants, predator movements, loss of cover, and erosion. Although specific work addressing effects of roads, trails, and OHV use on sagebrush habitats and sage-grouse has not been conducted, research suggests common effects including habitat loss and fragmentation, invasive plant spread, induced displacement or avoidance behavior, creation of movement barriers, noise, and direct encounters (Knick and others, 2011) and reducing the extent and influence of roads and trails can be incorporated into near-term and long-term plans for consolidating, conserving, and improving priority habitat areas. Other human-dimensions approaches may also prove valuable whereby closures and restrictions may be avoided by adjusting user behaviors through education and voluntary behavior changes.

Training Facilities

There are 87 Department of Defense (DoD) managed facilities distributed across the Sage-grouse Conservation Area with various operations and intensity of use among and within those facilities. Obvious land-use impacts were evident on approximately 17 percent of those lands, leaving substantial

Table 24. Interpreting range condition for treatment and restoration: An adaptable and consistent decision matrix using vegetation and soil characteristics*.

Level of implementation for restoration.[1]	Good to High Condition, little departure from reference conditions	Moderate to Good Condition, some departure from reference conditions but some important components remain	Poor Condition, Change in Dominance, full departure from reference conditions, typically associated with change of system state
		Description	
Differences may be ascribed to good range conditions reducing need, complicating environmental factors that reduce potential and (or) social-political-management factors that limit options.	*Structural and functional groups of vegetation are present—relative abundance and vigor of populations may vary; minor exotic/invasive species component may be part of pre-existing vegetation.*	*Functional or structural vegetation groups may be missing, under-represented, or in decline; invasive plants may be common but not dominant such that natives have been entirely displaced.*	*Sagebrush and tall grasses (usu. native) are missing or rare; invasive species dominate large areas; soil stability, water, and nutrient retention are likely altered; disturbance regimes may be altered.*
Low effort	Minimal actions: maintain status and protect intact shrub stands (for example, from wildfire), monitor and treat invasive species, monitor productivity and grazing intensities to reserve appropriate cover. Adjust management as necessary to maintain status.	Passive Restoration, including rest from grazing may be supplemented with localized (small areas) treatments or restoration actions. If habitat and range conditions are not improved consider increasing Active Restoration.	Active Restoration required. Prioritize based on regional habitat distribution and spatially explicit strategic planning; Potential for success with minimal (less) effort exists if soil quality and condition is good, invasive species control is possible and practical (not cost prohibitive).
Moderate effort	Minimal actions: maintain status and protect intact shrub stands (for example, from wildfire), monitor and treat invasive species, monitor productivity and grazing intensities to reserve appropriate cover. Increase effort and alter management if condition decline is documented or suspected.	Passive Restoration, including rest from grazing may be supplemented with localized (small areas) treatments or restoration actions. If habitat and range conditions are not improved consider increasing Active Restoration.	Active Restoration required. Prioritize based on regional habitat distribution and spatially explicit strategic planning; Potential for success with minimal (less) effort exists if soil quality and condition is good, invasive species control is possible and practical (for example, not cost prohibitive).
High effort	Minimal actions: monitor and treat invasive species, monitor productivity and grazing intensities to reserve appropriate cover, maintain status and protect intact shrub stands (for example, from wildfire). Implement Passive Restoration and consider further altering management if condition decline is documented.	Passive Restoration recommended unless significant funds and motivation exist (for example, industrial site reclamation) for conducting Active Restoration of soils and vegetation. No change in action (for example, grazing rotation) will be the best practice in many areas—to avoid a sudden change in disturbance regime and (or) exotic species invasion.	Unless significant funds and motivation exist (for example, industrial site reclamation) for conducting Active Restoration of soils and vegetation, inventory and reclassification is recommended. New management plans may be developed based on the new designation.

*Adapted from Pyke (2011).

[1]Field estimation and comparison of results to models and (or) reference conditions is required for accurate determination of position within this matrix.

portions of some facilities available for conservation and management of native species (Knick and others, 2011). However, only 26 percent (1.68 million acres [6,815 km^2]) of DoD facilities in the region are sagebrush dominated, and thus they represent only 0.01 percent of the currently estimated sage-grouse range (165.5 million acres [670,000 km^2] total area). Whereas the land-use and conservation activities of DoD may have important local effects on the distribution of sage-grouse habitats (including effects on disturbance regimes) as well as some populations (for example, the Saylor Creek Range in Idaho), they represent only a small portion of the species' range and therefore a small component of the conservation effort. Localized effects include woody plant eradication due to high-frequency fire returns (munitions testing and training) and fine-scale fragmentation due to concentrated, repeated vehicle maneuvers (Knick and others, 2011).

Factor B. Population Overutilization

In their review of threats to sage-grouse, USFWS recognized potential for "Overutilization for Commercial, Recreational, Scientific or Educational Purposes" as limited and not likely a factor (Valone and others, 2002) in the rangewide decline of sage-grouse. However, USFWS also recognized the ability of hunting to have significant effects on some populations, and further, the potential for interactive effects with indirect pressures from land-use development and other direct pressures, including predation and disease, makes close monitoring and annual adjustment of harvest rates a potentially important aspect of local population management. Importantly, sage-grouse are not currently commercially exploited anywhere in their range, and hunting of this species is prohibited in Canada and Washington. The other States within the species' range have direct management authority over hunting, which is exercised through Fish and Game Divisions (see Section IV. Factor D). Utilization of sage-grouse populations includes hunting, religious and traditional uses, and research and education; the number of animals affected by hunting far outweighs the number of mortalities associated with traditional, research, and educational activities, which have been considered and were deemed insignificant. Therefore, hunting practices and regulations are primarily discussed here.

To put hunting mortality in perspective, we recognize that sage-grouse, like other upland game birds, are exposed to a variety of predators including corvids (for example, common raven, *Corvus corax*), raptors (for example, golden eagle, *Aquila chrysaetos*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), badger (*Taxidea taxus*), weasels (*Mustela* spp.), ground squirrels (*Spermophilus* spp.), bobcat (*Lynx rufus*), western rattlesnake (*Crotalus viridus*), and bull snake (*Pituophis catenifer*) (Connelly and others, 2011a). Most mortality of sage-grouse is caused by predators during spring, summer, and fall seasons with limited mortality observed during winter months. Despite these natural pressures, significant mortality can be associated with hunting (Connelly and others, 2000b; Connelly and others, 2011a, p.66; Gibson and others, 2011). Hunting is generally concentrated during short periods of time in the fall, but several indigenous American tribes occasionally harvest animals in spring months. Besides concerns over additive mortality effects, which account for direct reductions in population numbers, research has documented potential bias towards adult-female mortality due to hunting, in particular, with an estimated 42 percent of seasonal female mortality associated with harvest practices (compared to 15 percent in males) in Idaho; however, this differentiation was not observed in Montana and Wyoming (Connelly and others, 2011a). If widespread and consistent, adult female bias could have important effects by altering the reproductive capacity of populations (Connelly and others, 2000b); further research and monitoring are needed along with potential for adjustment to harvest regulations, if warranted. At this time, "[n]o studies have demonstrated that hunting [or any other direct utilization] is a primary cause of reduced numbers of Greater [S]age-[G]rouse" (Reese and Connelly, 2011, p.101), but evidence indicates significant variability in the abundance and distribution of birds through time and across landscape units, including decreased survival in October (hunting season) in some populations (Sedinger and others, 2011). Elucidation of connections between sage-grouse populations, habitat conditions, and mortality factors, including harvest, will require well-designed and implemented studies that can separate contributing factors.

B1. Hunting

In recent decades, as information about sage-grouse mortality, survival, and reproductive rates has improved, and paradigms regarding population management were adjusted as State wildlife management agencies responded to population dynamics and declining population numbers by reducing annual harvests. Wyoming, Utah, Idaho, Oregon, Montana, and California reduced harvests in recent years through various regulatory mechanisms; Washington no longer permits harvest of sage-grouse, and Colorado, Nevada, North Dakota, and South Dakota have retained fairly consistent regulations during the past decade (Reese and Connelly, 2011). Nevada has closed several counties and hunting units to sage-grouse hunting (including Bi-State population protections) in the past 20 years. Sage-grouse have not been commercially harvested since the 1930s; therefore, commercial hunting does not currently affect sage-grouse population dynamics (U.S. Fish and Wildlife Service, 2010b). Recent work comparing populations with consistently different harvest structures indicated that populations in areas closed to hunting had growing breeding populations, whereas areas open to hunting had declining population growth rates, even under moderate rates of harvest (Connelly and others, 2003a). Importantly, hunted populations within this study demonstrated both decreasing trends and increasing trends during the 6-year study, emphasizing the importance of *local* factors for determining harvest levels and the need to balance mortality within the tolerance of each population (Connelly and others, 2003a; Sedinger and others, 2010).

Approaches and concepts used in upland small game management were developed early in the 20th century (circa 1930s), and these early approaches employed little empirical evidence and a single universal paradigm to establish harvest rates (Strickland and others, 1994; Reese and Connelly, 2011). These early approaches assumed that all small game populations exhibited high reproductive rates and low year-to-year survival, thereby suggesting that hunting, even at high-harvest levels, was compensatory to over-wintering mortality (that is to say, winter survival rates account for greater mortality than hunting; therefore, there is no net effect on the population due to hunting). Based on this paradigm, harvest regulations have varied tremendously over time and from State-to-State during the past 100 years, including a population crash and subsequent recovery in the late 1800s (Reese and Connelly, 2011). As research and harvest data for sage-grouse began to increase, evidence indicated that in some situations, harvest *can* have an *additive* effect on mortality, and the in mid-1990s, revised estimation of sage-grouse vital rates (life-span, mortality, and survival) caused Idaho and Wyoming to reduce the number of harvested animals (Reese and Connelly, 2011) to avoid additive mortality effects. Recent estimates and comparison of mortality rates for two populations, in Colorado and Nevada, found no evidence for additive mortality due to existing hunting of those populations (Sedinger and others, 2010).

Monitoring of harvest demographics along with lek counts and targeted population research combined have contributed to understanding of the dynamics of sage-grouse populations at landscape scales, including calculation of sex and age ratios, nest and brood success rates, and seasonal mortality (Autrienth, 1981). Further, hunters and hunting associations represent important supporters of wildlife conservation efforts from a range of social and political backgrounds; this constituency can be important for species conservation (Reese and Connelly, 2011). Nonetheless, appropriate harvest rates have not been determined for sage-grouse populations region-wide; however, several studies have addressed this issue (Autrienth, 1981; Crawford, 1982; Braun and Beck, 1985; Connelly and others, 2000a). Since public interest, population data, and management funds are derived from harvest of sage-grouse, hunting might be a part of conservation management in the future, for instance, if population numbers exceed suitable habitat. However, because populations appear to respond positively when released from hunting pressure, relief from hunting may remain a useful management strategy for populations with multiple, interacting stressors.

B2. Religious and Traditional

Several indigenous American tribes harvest sage-grouse populations within their jurisdictions associated with ceremonial practices and subsistence. Annual hunting occurs on the Wind River Indian Reservation (Wyoming), the Shoshone-Bannock Reservation (Idaho), and formerly on the Duck Valley Indian Reservation (Idaho-Nevada) (U.S. Fish and Wildlife Service, 2010b). Harvest activities on the Duck Valley Indian Reservation were suspended after West Nile virus caused precipitous population declines, demonstrating the ability of local governance bodies to respond to population estimates and adjust harvest practices accordingly. Harvest on the Wind River Reservation was limited to males on leks through 2009, and was perceived to have little to no measureable effect on the local populations; and all hunting on the Reservation has been closed at the recommendation of USFWS, due to population declines (Hnilicka, USFWS, Lander, Wyo., oral commun. April 2013). There are no known harvests of sage-grouse by indigenous tribes in Colorado, Oregon, North Dakota, South Dakota, or Washington (U.S. Fish and Wildlife Service, 2010b).

B3. Science and Education

Dozens of scientific studies have been conducted on sage-grouse, including at least 50 that have directly handled birds. Based on 2005 estimates, the mortality rate due to capture, handling, or radio-tagging process was approximately 2.7 percent of capture rate (68 mortalities of 2,491 captured) (U.S. Fish and Wildlife Service, 2010b); there is no evidence that this level of mortality causes measureable impacts on sage-grouse populations. Efforts to re-establish populations in several U.S. States and British Columbia documented translocation of more than 7,000 birds (Reese and Connelly, 1997); however, only 5 percent of these were successful in producing sustained resident populations, thus indicating high mortality risks and limited benefits from these activities (Reese and Connelly, 1997). However at least one translocation effort (Strawberry Valley, Utah) demonstrated greater success with estimated 60-percent survival rates (Baxter and others, 2008). Based on the low number of translocated animals distributed across many years, and the low number of mortalities associated with research and restoration activities relative to population totals and other sources of mortality, USFWS indicated that research and education effects on source populations were minimal (U.S. Fish and Wildlife Service, 2010b).

Factor C: Population Disease and Predation

Disease

Although sage-grouse are host to a wide array of parasites and pathogens, including macroparasitic arthropods, helminthes, and microparasites (protozoa, bacteria, viruses, and fungi) (Thorne and others, 1982; Connelly and others, 2004; Christiansen, 2011), little effort was devoted to the monitoring of disease in sage-grouse prior to the emergence of West Nile virus (WNv). As such, few records exist to reveal the role disease may have played in population declines of sage-grouse (Connelly and others, 2004; Christiansen, 2011; Connelly and others, 2011c). Thorough reviews of disease impacts on sage-grouse can be found in Christiansen and Tate (Wyoming Executive Order) and Connelly and others (2004). Ectoparasites supported by sage-grouse include lice, ticks, and dipterans (Connelly and others, 2004; Christiansen, 2011; Connelly and others, 2011c). Most ectoparasites cannot produce disease but serve as vectors of transmission and can be detrimental if the bird is stressed (Thorne and others, 1982; Peterson, 2004). High louse concentrations have been shown to limit breeding opportunities of male sage-grouse due to female avoidance of affected males and may therefore potentially impact the genetic diversity of the species (Boyce, 1990; Deibert, 1995; Connelly and others, 2011c).

Two internal parasites have caused fatalities in sage-grouse: the disease coccidiosis is spread via protozoans *Eimeria spp.* (Connelly and others, 2004; Hagen and Bildfell, 2007) and possibly ixodid ticks (*Haimaphysalis cordeilishas*). A tularemia (*Francisella tularenis*) outbreak coincided with the mortalities attributed to an ixodid tick infestation (Parker and others, 1932; Christiansen, 2011). It is likely that the tularemia, in combination with the high number of ticks feeding on the birds, resulted in bird mortalities (Christiansen, 2011). This is the only reported case of tularemia in sage-grouse. Coccidiosis, though not common today, was once prevalent throughout sage-grouse range (Christiansen, 2011). This parasite causes decreased growth and significant mortality in young birds (Thorne and others, 1982; Connelly and others, 2004; Christiansen, 2011). Those birds that survive appear to develop immunity from subsequent infections (Thorne and others, 1982; Connelly and others, 2004). Outbreaks of coccidiosis have been clustered in areas where large numbers of birds gather causing the soil and water to become contaminated with fecal material (Scott, 1940; Honess, 1968; Connelly and others, 2004; Christiansen, 2011) and may regulate small, isolated populations of grouse (Peterson, 2004). Some researchers suggest that the decline in coccidiosis cases is directly related to the declining density of sage-grouse (Christiansen, 2011).

Bacteria and fungi can also occur in sage-grouse (Scott, 1940; Honess, 1968; Hausleitner, 2003; Connelly and others, 2004; Peterson, 2004; Hagen and Bildfell, 2007; Christiansen, 2011), but none currently play a role in limiting sage-grouse populations. This may change if environmental conditions result in greater concentrations of birds, leading to contamination of water supplies with fecal material (Christiansen, 2011). Prior to 2002, avian infectious bronchitis was the only identified virus infecting sage-grouse, and no clinical signs were noted (Peterson, 2004). West Nile virus (WNv) was introduced into North America in 1999 (Marra and others, 2004) and was first documented in sage-grouse in 2002 (Walker and Naugle, 2011). Although the disease is presently patchily distributed, it represents the only active disease that threatens sage-grouse populations with heavy mortality (U.S. Fish and Wildlife Service, 2010b). Sage-grouse are highly susceptible to WNv and suffer high rates of mortality (Clark and others, 2006; McLean, 2006). For example, data from four studies showed a 25 percent decline in sage-grouse numbers in July and August of 2003 (Naugle and others, 2004) and decline in male and female lek attendance in 2004 (Walker and others, 2004). Populations not exposed to WNv did not experience a similar decline. Deaths from WNv occur in mid-summer, a time when survival is typically high (Schroeder and others, 1999; Aldridge and Brigham, 2003a) making these losses additive and reducing annual survival (Naugle and others, 2005). These data suggest that WNv could contribute to local population extirpation (Walker and others, 2004; Naugle and others, 2005). Resistance to WNv is very low with exposure to the virus typically resulting in mortality of sage-grouse (Clark and others, 2006; Walker and Naugle, 2011). It is unknown if birds surviving exposure to WNv develop immunity to future exposure (Clark and others, 2006; Walker and Naugle, 2011) or if residual effects such as reduced productivity or overwinter survival occur (Walker and others, 2007b).

The distribution and probability of WNv outbreak in these rural semiarid environments is poorly understood; however, the WNv life-cycle provides applicable insights. The primary vector of WNv in sagebrush ecosystems is the mosquito *Culex tarsalis* (Naugle and others, 2004; Naugle and others, 2005; Walker and Naugle, 2011). WNv persists through a mosquito-bird-mosquito infection cycle (McLean, 2006), although bird-to-bird transmission has been observed (McLean, 2006; Walker and Naugle, 2011). The severity of WNv outbreaks and the transmission of the disease are primarily regulated by environmental factors including temperature, precipitation, and proximity to anthropogenic water sources, which support mosquito larvae (McLean, 2006; Reisen and others, 2006; Walker and Naugle, 2011). Mosquito activity and virus amplification is hindered by cold temperatures, restricting transmission to the summer months (Naugle and others, 2005; Zou and others, 2007). Cooler ambient temperatures at higher elevations and in more northerly locations may reduce the exposure risk of sage-grouse living in these areas (Naugle and others, 2004; Naugle and others, 2005; Walker and Naugle, 2011).

Although *C. tarsalis* is able to overwinter and individual mosquitos emerge as infected adults in the spring (Clark and others, 2006; Walker and Naugle, 2011), the species is dependent on the availability of warm pools of water for larval development. As such, the ongoing proliferation of anthropogenic surface-water features (stock ponds, coal bed methane discharge ponds, irrigated agricultural fields, and so forth) could help maintain or possibly increase the occurrence of WNv on the landscape (Friend, 2001; Zou and others, 2006; Walker and others, 2007b; Walker and Naugle, 2011). Mosquitoes are able to disperse up to 18 km (11.2 mi) from their larval pond (Clark and others, 2006; Walker and Naugle, 2011) implying that the entire sage-grouse range could potentially be exposed to the virus and that the prevalence of it will likely increase (U.S. Fish and Wildlife Service, 2010b). If minimizing the impact of WNv on sage-grouse is warranted due to local population dynamics, controlling the number of mosquitos emerging from anthropogenic water sources and reducing availability of these water features as habitat may be important options. Sage-grouse do not require standing water

(Schroeder and others, 1999; Connelly and others, 2004); therefore, the practice of placing water developments in arid landscapes for the benefit of sage-grouse may be reduced or eliminated (Clark and others, 2006; Walker and Naugle, 2011) without expectation of population impacts. Water sources may have specific value for managing some landscapes, but the threat of spreading WNv through anthropogenic water sources indicates consideration of control or mitigation to discourage breeding mosquitos either through construction, modification, or management (Doherty, 2007) may be warranted. The biting midge *Culicoides sonorensis* has also been identified as a possible vector of WNv (Schmidtmann, 2005); this species requires muddy banks to lay its eggs and therefore may particularly be a factor in areas with large numbers of stock ponds. *C. sonorensis* is an important vector of blue-tongue in ruminants, and though it is not known if they actively feed on avifauna, WNv was found in a midge sample from the Powder River Basin, Wyoming (Schmidtmann, 2005). Because of the large number of water sources and their widespread distribution, mitigation measures may be cost prohibitive (U.S. Fish and Wildlife Service, 2010b), but may be warranted when sage-grouse populations are small, isolated, or genetically limited (U.S. Fish and Wildlife Service, 2010b). Caution is warranted when employing mosquito control to ensure that benefit from reducing the occurrence of WNv is not overshadowed by cascading ecological effects (Marra and others, 2004). WNv fowl vaccines were tested in captive birds and were largely ineffective (Clark and others, 2006; Walker and Naugle, 2011). Development of a sage-grouse specific vaccine would require market incentive and would likely not be practical for large-scale deployment (U.S. Fish and Wildlife Service, 2010b).

Models suggest that the prevalence of WNv is likely to increase throughout the range of sage-grouse as the number of anthropogenic water sources and ambient temperatures increase (U.S. Fish and Wildlife Service, 2010b). Sage-grouse populations will respond differently to WNv infections depending on factors that affect exposure and susceptibility (Clark and others, 2006; Walker and Naugle, 2011). Though larger populations may be able to absorb losses from WNv as long as available habitat is sufficient (Clark and others, 2006; Walker and Naugle, 2011), a WNv outbreak in small, isolated, or genetically limited populations may be devastating and could reduce a population beyond a point where recovery is possible (Clark and others, 2006; Walker and Naugle, 2011).

Sage-grouse gather in mesic habitats during the mid-to late summer (Connelly and others, 2000c) making them potentially more vulnerable to all of the pathogens discussed. More dispersed populations in less arid habitats may not suffer the same threats. Historically, obvious morbidity and mortality in sage-grouse caused by the pathogens discussed above was tied to higher concentrations of sage-grouse localized near water sources during dry conditions (Scott, 1940; Honess, 1968; Connelly and others, 2004; Christiansen, 2011). "Likely" climate-change scenarios, according to the Intergovernmental Panel on Climate Change (IPCC, 2007), suggest the impacts of disease on sage-grouse could increase (Neilson and others, 2005) as habitat conditions become limiting due to increased temperatures and drought conditions predicted to occur across the sagebrush biome (IPCC, 2007). If realized, these conditions could particularly limit the availability of mesic areas, potentially leading to high densities of sage-grouse around these areas and other anthropogenic water sources. Past outbreaks of bacterial infections, coccidiosis and WNv, have been linked to such circumstances.

Predation

Typically sage-grouse live between 3 and 6 years, with individuals up to 9 years of age reported in the wild (Connelly and others, 2004). Predation is commonly identified as the primary cause of direct mortality for sage-grouse at all life stages (Schroeder and others, 1999; Connelly and others, 2000; Connelly and others, 2011), but there is little published support for predation being a limiting factor in sage-grouse populations (Connelly and others, 2004), particularly in areas where there is high-quality habitat (Hagen, 2011). Sage-grouse have co-evolved with a suite of predators, including coyotes (*Canis latrans*), badgers (*Taxidea taxus*), bobcats (*Felis rufus*), and red fox (*Vulpes vulpes*). Several raptor species are common predators of juvenile and adult sage-grouse (Patterson, 1952; Schroeder and others, 1999; Schroeder and Baydack, 2001), and coyote, badger, common raven (*Corvus corax*), and black-billed magpie (*Pica hudsonia*) are regular nest predators. Ground squirrels (*Spermophilus* spp.) were once thought to be major nest predators, but recent evidence indicates that the mandibles of some ground squirrel species are physically unable to puncture sage-grouse eggs (Holloran and Anderson, 2003; Coates, 2007). The degree and significance of snake predation on sage-grouse nests is unknown (Holloran and Anderson, 2003; Coates, 2007). Cryptic coloration, habitat selection, and behavioral patterns have allowed sage-grouse to persist throughout sagebrush habitats (Schroeder and others, 1999), co-existing with these predators. Although sage-grouse have a number of predators, none are known to focus on sage-grouse as a primary food source. Most predators of sage-grouse depend primarily on rodents and lagomorphs (Schroeder and others, 1999); however, alternate prey, such as sage-grouse, may still experience high-predation rates either because they are targeted when the primary prey become scarce or if predators kill indiscriminately as predator numbers increase (Norrdahl and Korpimaki, 2000).

Male sage-grouse have the greatest exposure to predation at leks (Schroeder and others, 1999; Schroeder and Baydack, 2001; Hagen, 2011) where they congregate and perform conspicuous mating displays. The concentration of birds present may attract a variety of predators and affect grouse-avoidance behavior (Aspbury and Gibson, 2004; Boyko and others, 2004). Because of the disproportionate predation on males during the breeding season, female sage-grouse have a longer life expectancy (Schroeder and others, 1999). Female sage-grouse are more susceptible to predators while nesting, but mortality rates are low as hens will abandon their nests when disturbed by predators (Hagen, 2011). Predation on sage-grouse outside of the lekking, nesting, and brood-rearing periods is rare (Connelly and others, 2000a; Moynahan and others, 2006; Hagen, 2011). The highly polygynous nature of sage-grouse suggests that sage-grouse populations are more sensitive to predation upon females (U.S. Fish and Wildlife Service, 2010b) because only a few males per lek breed each year. Predation of breeding hens and young chicks may negatively affect sage-grouse population numbers as these two cohorts are the most significant contributors to population productivity (Baxter and others, 2008; Connelly and others, 2011a).

Human encroachment into sagebrush habitats has affected the predator–sage-grouse dynamic. The act of altering the landscape can create an influx of predators into an area and lead to a decline in annual recruitment (Gregg and others, 1994; Delong and others, 1995; Braun, 1998; Schroeder and Baydack, 2001; Coates, 2007; Hagen, 2011). Predators that are closely associated with human development, red fox and corvids, have increased in abundance over the sagebrush landscape (Sovada and others, 1995). These species in particular have been shown to be efficient predators of nests and juvenile sage-grouse (Schroeder and others, 1999). As sage-grouse habitat is lost or fragmented due to energy development, agriculture, or exurban development, quality nesting and brood-rearing habitat becomes restricted (Bui, 2009). The higher density of grouse in lower quality habitat combined with potentially easier predator access along roads, fence rows, edges, and trails, may make foraging easier for predators (Connelly and others, 2004; Holloran, 2005; Holloran and others, 2005; Aldridge and Boyce, 2007; Bui, 2009). In addition to habitat loss and fragmentation, ranches, farms, and other housing developments have led to the introduction of domestic dogs (*Canis domesticus*) and cats (*Felis domesticus*) into sage-grouse habitats, both of which may prey upon grouse (Connelly and others, 2004; Holloran, 2005; Holloran and others, 2005; Aldridge and Boyce, 2007; Bui, 2009). Roads have been shown to be particularly efficient as mechanisms of distribution for predators throughout the sagebrush landscape. Some mammalian species (Forman and Alexander, 1998; Forman, 2000) and ravens (Knight and others, 1993; Connelly and others, 2004) have used these linear features to expand their distribution into previously unused regions, increasing the risk of predation to sage-grouse.

Nest predation has been linked to low herbaceous cover (Gregg and others, 1994; Delong and others, 1995; Braun, 1998; Schroeder and Baydack, 2001; Coates, 2007; Coates and others, 2008; Hagen, 2011). Sage-grouse select nesting sites specifically based on the amount of grass and forb cover (Hagen and others, 2007) because it is needed to conceal the nest from predators. Reduction of grass height due to livestock grazing below 4 in. (18 cm) has been shown to negatively affect nest survival (Gregg and others, 1994). However, abundant cover has also been shown to facilitate badger predation because it attracts small mammals, the primary prey of badgers (Coates, 2007). Adequate grass and forb cover provides valuable hiding cover for young chicks (Schroeder and Baydack, 2001), a life stage during which mortality due to predation has been estimated to be highest, at 82 percent (Gregg and others, 2007).

To support maintenance of suitable grass and forb cover and minimize associated predation risks, careful monitoring of grazing allotments within sage-grouse nesting habitat may be coupled with livestock management to ensure suitable grass and forb cover is reserved. In addition, pasture fencing creates perching sites for raptors and corvids and travel corridors for coyotes and foxes, increasing predation risk across many habitats (Call and Maser, 1985; Braun, 1998; Connelly and others, 2000b; Beck and others, 2003; Knick and others, 2003; Connelly and others, 2004) and leading to habitat avoidance by sage-grouse (Call and Maser, 1985; Braun, 1998; Connelly and others, 2000b,; Beck and others, 2003; Knick and others, 2003; Connelly and others, 2004).

Similarly, power poles, towers, and fence posts provide attractive hunting and roosting perches for corvids and raptors (Steenhof and others, 1993; Connelly and others, 2000b; Manville, 2002; Vander Haegen and others, 2002; Connelly and others, 2004). Power poles can increase a raptor's range of vision and allow for greater speed during attacks, increasing their hunting efficiency (Steenhof and others, 1993; Connelly and others, 2000b; Manville, 2002; Vander Haegen and others, 2002; Connelly and others, 2004). After the installation of transmission lines, densities of raptors and corvids increased markedly (Ellis, 1985; Steenhof and others, 1993) as did predation on sage-grouse (Ellis, 1985; Steenhof and others, 1993). Power lines may also cause changes in lek dynamics, with lower growth rates observed on leks within 0.25 mi (0.4 km) of new power lines in the Powder River Basin of Wyoming as compared to those farther from the lines. This was attributed to increased raptor predation (Braun and others, 2002). Raptors and corvids forage on average 3.1 to 4.3 mi (5 to 6.9 km) from perching sites, potentially impacting 32 to 40 percent of the sage-grouse conservation area (Connelly and others, 2004). Removing or reducing the number of perching structures and landfills in key nesting, brood rearing, and lekking habitats may reduce predation pressure on sage-grouse (Bui, 2009; Leu, 2011).

Predator Control

Although there is little published information supporting the notion that predation is a limiting factor on sage-grouse (Connelly and Braun, 1997; Connelly and others, 2000b; Schroeder and Baydack, 2001), arguments continue to be made supporting predator control as an important management action (Wambolt and others, 2002). Additionally, relatively high annual survival rates of adult sage-grouse (0.59–0.77 for females, 0.37–0.63 for males) (Zablan and others, 2003) accompanied by documented ineffectiveness of coyote control in affecting nest survival in one area in Wyoming (Slater, 2003), further reinforce the idea that predation is not a widespread factor acting to depress sage-grouse populations. Where predator removal has been used as a management tool, higher numbers of sage-grouse have sometimes been observed in the fall, but these gains have not carried over to spring breeding populations (Cote, 1997; Hagen, 2011; Leu, 2011). The removal of coyotes in some areas has resulted in an increase in the numbers of mesopredators, which may have greater impacts on grouse populations (Mezquida and others, 2006). Similarly, raven removal in northeastern Nevada resulted in only short-term reductions in raven numbers (Coates, 2007), and any benefits to sage-grouse populations were negated by an increase in badger predation (Coates, 2007). Predator removal may be warranted in areas with low habitat quality (that is, heavily fragmented or areas of high anthropogenic disturbance) supporting inflated numbers of synanthropic predators; however, predator numbers will rebound quickly without continual control (Hagen, 2011).

Factor E: Pesticides and Contaminants

Because of the overlap between current cropland distributions and historically high-quality sagebrush habitats (deep loamy and sandy loam soils, valley bottoms, and wet meadows) and fidelity of sage-grouse populations to these habitats (Berry and Eng, 1985; Dunn and Braun, 1985; Fischer and others, 1993; Holloran and Anderson, 2005; Holloran and others, 2010), there can be considerable summer use of agricultural lands by sage-grouse even though current sagebrush cover may be relatively low. With these overlapping uses comes risk of poisoning by pesticides (Blus and others, 1989; Connelly and Blus, 1991) and other chemicals used in vegetation and pest management. Many of these factors may have indirect effects on health and fitness, in addition to the obvious effects on survival (Connelly and others, 2004; table 25).

Pesticides

Sage-grouse typically avoid human developments and highly cultivated landscapes; however, because these lands often replaced historically important habitats and remain adjacent to remaining sagebrush habitats, use of these areas characterized by “low nest success” and “poor chick survival” (due to increased risks) remains common on some landscapes (Aldridge and Boyce, 2007). Nonetheless, irrigated crops, hay, and pastures represent an attractive source of foods including insects, especially during drought years and later in the brood-rearing season when native forbs become desiccated (Hagen, 2007; Connelly and others, 2011d; Knick and others, 2011). Research using collared animals found that 18 percent of marked sage-grouse in Idaho used croplands adjacent to sagebrush habitat that had been sprayed by dimethoate and methamidophos (Blus and others, 1989). Posthumous assessments indicated 5 percent mortality in the first year and 16 percent in the following year due to organophosphorus poisoning. This research was focused in an area with extensive agricultural development adjacent to sagebrush habitats; therefore, similar concentrations may be anticipated in similarly developed areas, but this level of mortality would extend rangewide only with similar applications.

In addition to direct impacts of pesticides through direct contact (Blus and others, 1989; Connelly and others, 2004), reduction of important seasonal foods such as forbs and insects can affect the forage base (Eng, 1952; Connelly and others, 2004); therefore, effects on sage-grouse seasonal habitat requirements may be an important consideration for pest and pesticide management. Insects are an important component of early brood-rearing habitat (Patterson, 1952; Klebenow and Gray, 1968; Johnson and Boyce, 1991). A complete assessment of early brood-rearing habitat includes an evaluation of insect abundance because they are an important part of seasonal diets. A depauperate or undependable invertebrate resource base is likely to depress growth rates and brood-rearing success (Connelly and others, 2004); however, vegetation alteration due to insect population peaks (outbreaks) may have negative effects on the forage base (Ritchie and Tilman, 1992; Scherber and others, 2010) suggesting need for future evaluation and management adaptation regarding population interactions with insect herbivores.

Herbicides

In addition to pesticides, several herbicides are commonly applied in and around the sagebrush ecosystem; alteration of desirable components of the habitat may be targeted or unintentional depending on the vegetation targets, for example, sagebrush or invasive species. Many enhancement and sagebrush restoration treatments involved alterations that include the removal of sagebrush (Carr and Glover, 1970; Klebenow, 1970; Connelly and others, 2004) to increase the cover and productivity of herbaceous species in the treatment areas. Although these treatments continue in many areas, decreased emphasis on sagebrush removal or reduction and increased emphasis on reducing invasive plant-species distributions mean that some chemicals may be applied on, or adjacent to, priority habitat areas. Most modern chemicals are applied at levels expected to decay quickly with minimal soil residuals. For example 2,4-D (2,4-Dichlorophenoxyacetic acid) degrades rapidly with half-life values estimated at 1–14 days (Gervais and others, 2008; table 25); however, detectable residues can persist for up to a year (Tu and others, 2001). Similarly, other commonly applied chemical herbicides, such as Imazapic (Plateau®, American Cyanamid Co.), Tebuthiuron (Spike80®, Dow AgroSciences LLC), and Glyphosphate (Round-up®, Rodeo®, Monsanto Co.) that interrupt cell chemistry had minimal effects on test animals and decay quickly in the environment. Tebuthiuron may cause mild skin irritation in mammals but is essentially nonirritating (tested on rabbits and guinea pigs); single-dose oral toxicity is moderate in mammals (LD50 for rats is 488mg/kg), but it is not a known carcinogen (Dow AgroSciences, 1999). Glyphosphate inhibits enzyme and amino acid formation in chloroplasts of most plant species; these organelles are not present in animal cells making transferred toxicity unlikely. Glyphosphate has an average half-life

Table 25. Insecticides and herbicides certified for application and commonly applied on and around sagebrush habitats.

Chemical	Use	Direct/Acute Effects	Indirect Effects
Dimethoate	Pesticide, forage, seed alfalfa	Very Toxic (Blus and others, 1989)	Reduced availability of insects for food
Methamidophos	Pesticide, seed alfalfa, potatoes; US registration cancelled 9/23/2009	Very Toxic (Blus and others, 1989)	Reduced availability of insects for food
Malathion	Pesticide, grasshoppers	Toxic	Reduced availability of insects for food
Carbaryl	Pesticide, grasshoppers	Low to Moderately Toxic	Reduced availability of insects for food
Dimilin	Pesticide, grasshoppers	Low Toxicity	Reduced availability of insects for food
2,4-D	Herbicide, sagebrush thinning	Low Toxicity	Reduced sagebrush cover; reduced forb availability
Plateau ® (Imazapic)[1]	Herbicide, cheatgrass	No more than slightly toxic	Reduced forb availability
Spike ® (Tebuthiuron) [1]	Herbicide, sagebrush thinning	Low to Moderately Toxic	Reduced sagebrush cover
Roundup ® (Glyphosphate) [1]	Herbicide	No more than slightly toxic	Reduced sagebrush cover; reduced forb availability

[1] Imazapic, Tebuthiuron, and Glyphosphate have chemical actions that target plant physiology; it is highly unlikely that they have a direct effect on sage-grouse at levels typically applied (according to manufacturer instructions).

of 47 days (Tu and others, 2001). According to the manufacturers, direct exposure to these chemicals may cause eye irritation, absorption through the skin, and inhalation toxicity effects. They are not known to bioaccumulate in animals and are rapidly excreted in urine and feces rendering them mostly nontoxic to a wide range of nontarget organisms including mammals, birds, fish, aquatic invertebrates, and insects (Tu and others, 2001). Direct assessment of toxicity effects on sage-grouse have not been conducted, but existing information indicates little concern for direct effects of certified herbicides on sage-grouse health.

IV. Factor D: Policies and Programs Affecting Sage-Grouse Conservation

In 2010, a lack of adequate regulatory mechanisms was determined by the USFWS to be a substantial threat to sage-grouse in its 12-Month Findings for Petitions to List the Greater Sage-Grouse (U.S. Fish and Wildlife Service, 2010b). In an effort to address sage-grouse conservation needs, many agreements and partnerships have been established across the sage-grouse range with various levels of commitment, jurisdiction, and participation. The national efforts of the BLM and USFS were outlined at the beginning of this report. To support continued facilitation and integrated management across administrative and political boundaries, this section documents existing and proposed conservation efforts directed at sage-grouse, including regulatory and nonregulatory approaches by Federal, State, and local agencies, as well as private lands and, where appropriate, the threats those efforts seek to address. This section aims to provide land managers and agency planners with an overview of those conservation activities, programs, and regulations across the range so that local and regional planning efforts may be recognized and continuing coordination across political and administrative boundaries encouraged.

One of the key challenges in implementing sage-grouse conservation efforts is the mixed pattern of surface-land ownership and jurisdiction across the species' range (Knick and Connelly, 2011b). This patchwork of land ownership is a result of historical public land policies that have guided disposition of public lands in the Western United States since their settlement (Knick and Connelly, 2011b). With such diverse ownership across a large range (table 26), regulatory actions and policies aimed at sage-grouse conservation require coordination across traditional geopolitical and landownership boundaries; a given population of sage-grouse can migrate between privately owned land and land administered by numerous Federal and State agencies (Stiver, 2011). Each class of surface ownership carries different management requirements and objectives. Notably, the BLM and USFS manage approximately 53 percent of the surface area across the region, with BLM jurisdiction over approximately 44 percent of the sage-grouse range and USFS administration of 4 percent of the range (estimated using PPH and PGH; table 26). Therefore, more than 50 percent of the surface area across the range is managed for multiple (often competing) uses including requirements to balance commodity production with wildlife (Knick and Connelly, 2011). The USFWS is the only Federal agency with an exclusive wildlife conservation mandate; however, it manages only one percent of the species' habitat (Knick, 2011). A large percent (31 percent) of surface area within the sage-grouse range remains in private ownership (Knick, 2011). States and other Federal agencies and departments manage the remainder of the surface area within the range (Knick, 2011).

Rangewide Conservation Efforts

The range of the sage-grouse includes habitat within the United States and Canada, with 99 percent of the current population found in the United States and the remaining 1 percent found in Canada (Stiver and others, 2006a). However, because the sage-grouse is not considered to be a migratory species, it is not afforded the protections of the Migratory Bird Treaty Act (16 U.S.C. § 703 *et seq*.; U.S. Fish and Wildlife Service, 2010b).

Though not regulatory mechanisms, a series of Memoranda of Understanding (MOUs) have been entered into by various State and Federal agencies that acknowledge the collaboration among the signatories. The partnerships formed by the MOUs have produced a rangewide conservation framework (Stiver, 2011). In 2004, the Western Association of Fish and Wildlife Agencies (WAFWA) in cooperation with the USFS, BLM, USFWS, and USGS (U.S. Geological Survey), published the Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats (Connelly and others, 2004), a comprehensive, ecologically focused analysis that documented the current status and potential factors influencing the long-term conservation of sage-grouse populations and sagebrush ecosystems. In 2006, WAFWA released the Greater Sage-Grouse Comprehensive Conservation Strategy (Stiver and others, 2006a), which includes seven substrategies to "maintain and enhance populations and distribution of sage-grouse by protecting and improving sagebrush habitats and ecosystems that sustain these populations." This strategy was itself a collaborative effort, reflecting the collective knowledge of local working groups, State and provincial conservation plans, Federal and State agencies, and a rangewide-issues forum (Stiver, 2011). In 2011, agency, academic, and private sector experts published a monograph on sage-grouse populations, sagebrush habitats, and the relations between land use and sage-grouse populations across the sage-grouse range (Knick and Connelly, 2011).

In the 2006 strategy, WAFWA recommended passage of the North American Sagebrush Ecosystem Conservation Act (NASECA, Stiver and others, 2006a). The NASECA is modeled after the North American Wetland Conservation Act, calls for leadership through the establishment of an NASECA Council, and proposes an initial five-year budget of $425 million to be administered by a fiduciary entity and dispersed across MZs, States, and provinces (Stiver and others, 2006a). The precise details of NASECA are to be determined by the Western Governors' Association, which along with WAFWA completed a draft version of the Act in 2009 (Stiver and others, 2006a; Western Governors' Association, 2011). In 2011, the Western Governors' Association requested Congress to pass the NASECA and appropriate the necessary funds for implementation (Western Governors' Association, 2011), and if approved, it will provide a rangewide funding mechanism to implement WAFWA's Comprehensive Conservation Strategy.

Canadian Conservation Efforts

The sage-grouse is a protected species in Canada under schedule 1 of the Species at Risk Act (SARA; Canada Gazette, 2002; U.S. Fish and Wildlife Service, 2010b). The Species at Risk Act, like its counterpart the Endangered Species Act, prohibits harming individuals within a protected species and allows for the protection of critical habitat (Aldridge and Brigham, 2003a).

Sage-grouse are also protected under the laws of the provinces of Alberta and Saskatchewan, neither of which allow harvesting of individual birds (Aldridge and Brigham, 2003a). In Saskatchewan, sage-grouse are listed as endangered under the Saskatchewan Wildlife Act, which restricts development within 1,640 ft (500 m) of leks and prohibits construction within 3,281 ft (1,000 m) of leks between March 15 and May 15 (Aldridge and Brigham, 2003a, p. 32). Additionally, under Saskatchewan's Wildlife Habitat Protection Act, sage-grouse habitat is afforded protection from transfer and cultivation (Aldridge and Brigham, 2003a). Alberta protects individual birds, but not sage-grouse habitat (Aldridge and Brigham, 2003a). USFWS has acknowledged these protections but concluded they are insufficient to assure conservation of the species (U.S. Fish and Wildlife Service 2010b).

United States Federal Agency Conservation Efforts

Natural Resources Conservation Service: Sage-Grouse Initiative

Launched in 2010, the USDA NRCS Sage-Grouse Initiative (SGI) supports work with private landowners in 11 Western States to improve habitat for sage-grouse while simultaneously improving working ranches (U.S. Natural Resources Conservation Service, 2012c). With approximately 31 percent of all sagebrush habitat across the range in private ownership (table 27; Stiver, 2011), a unique opportunity exists for NRCS to benefit sage-grouse and ensure the persistence of large and intact rangelands through implementation of the SGI (U.S. Fish and Wildlife Service, 2010a).

Table 26. Summary of management jurisdiction* across Management Zones (MZs) by acres of preliminary priority and preliminary general habitats (PPH and PGH, respectively).

Management Zone Entity	Total Surface Area (acres)	PPH SG Habitat (acres)	PPH Area (%)	PGH SG Habitat (acres)	PGH Area (%)
MZ I–GP	**84,110,800**	**11,636,400**	**13.8**	**34,663,000**	**41.2**
BLM	8,325,300	2,994,300	36.0	4,524,900	54.4
Forest Service	4,532,500	292,400	6.5	515,300	11.4
Tribal and Other Federal	5,458,500	219,700	4.0	2,427,700	44.5
Private	54,998,900	7,132,500	13.0	24,682,800	44.9
State	5,421,400	995,600	18.4	2,498,400	46.1
Other	5,374,100	1,900	0.0	13,900	0.3
MZ II and VII–WB & CP	**92,776,100**	**17,476,000**	**18.8**	**19,200,200**	**20.7**
BLM	30,295,000	9,021,200	29.8	9,012,500	29.7
Forest Service	23,558,800	162,000	0.7	452,500	1.9
Tribal and Other Federal	7,086,200	784,000	11.1	1,354,600	19.1
Private	27,405,400	6,233,900	22.7	7,394,800	27.0
State	4,053,900	1,244,800	30.7	979,800	24.2
Other	376,700	30,100	8.0	6,000	1.6
MZ III–SGB	**78,429,300**	**10,028,500**	**12.8**	**3,970,100**	**5.1**
BLM	45,097,500	6,309,400	14.0	3,199,800	7.1
Forest Service	12,377,600	1,236,200	10.0	356,200	2.9
Tribal and Other Federal	5,282,700	260,800	4.9	29,100	0.6
Private	12,251,400	1,836,200	15.0	384,800	3.1
State	3,101,900	385,900	12.4	200	0.0
MZ IV–SRP	**78,259,200**	**21,930,600**	**28.0**	**10,958,500**	**14.0**
BLM	26,220,300	13,710,700	52.3	4,928,200	18.8
Forest Service	22,291,600	1,613,800	7.2	1,113,500	5.0
Tribal and Other Federal	2,431,000	633,600	26.1	522,500	21.5
Private	23,150,400	4,890,200	21.1	3,516,700	15.2
State	3,681,000	1,019,400	27.7	846,200	23.0
Other	484,800	62,900	13.0	31,400	6.5
MZ V–NGB	**36,447,900**	**7,097,200**	**19.5**	**5,808,000**	**15.9**
BLM	14,179,800	5,117,500	36.1	4,196,700	29.6
Forest Service	10,136,000	62,200	0.6	114,900	1.1
Tribal and Other Federal	1,964,700	717,100	36.5	101,800	5.2
Private	6,299,000	798,000	12.7	1,199,000	19.0
State	473,600	64,900	13.7	115,800	24.5
Other	3,394,700	337,500	9.9	79,800	2.4

*Data Sources: BLM GSSP Surface Management Agency 2012; USFS Enterprise Data Warehouse 2012. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

Table 27. Sage-Grouse Initiative efforts by State (through 2011) with delineation of threats to sage-grouse targeted with mitigation.

State	Acres to be Treated with Improved Grazing Systems	"High Risk" Fence to be Marked or Removed (ft)	Acres of Pinyon-Juniper to be Removed	Habitat Loss Due to Fire or Conversion for Agriculture (total acres to be restored)	Brood Rearing Habitat Improvements (acres)	Conservation Easements (acres secured)
California	23,395	420,501	28,665	1,020	66	–
Colorado	18,817	9,676	555	3,661	4	5,017
Idaho	206,170	309,892	5,600	4,449	370	21,434
Montana	246,814	460,854	–	883	–	42,191
Nevada	4,571	81,637	7,423	3,732	5,883	3,695
N. Dakota	4,213	2,909	–	565	–	–
Oregon	8,488	5,280	54,626	–	–	–
S. Dakota	127,812	–	–	–	–	–
Utah	48,462	52,765	18,525	11,986	–	14,980
Wyoming	414,422	401,281	22	29	60	120,706
Totals	**1,103,164**	**1,744,795**	**115,416**	**26,325**	**6,383**	**208,023**

Participation in the SGI program is voluntary, but willing participants enter into binding contracts or easements to ensure that conservation practices that enhance sage-grouse habitat are implemented (U.S. Fish and Wildlife Service, 2010a). Though participation is voluntary, and thus not a traditional regulatory approach, participating landowners are bound by contract (usually three to five years in duration) to implement, in consultation with NRCS staff, conservation practices if they wish to receive the financial incentives offered by the SGI. These financial incentives generally take the form of payments to offset costs of implementing conservation practices and easement or rental payments for long-term conservation (U.S. Fish and Wildlife Service, 2010b). Demand to participate in the program has been strong; as of March 2012, 462 ranchers were enrolled in the SGI, covering 1.7 million acres (6,880 km^2; U.S. Natural Resources Conservation Service, 2012a). Funding for the SGI, through conservation programs provided for in the Food, Conservation, and Energy Act of 2008 (Farm Bill), has increased to meet the interest—from $21 million in fiscal year (FY) 2010 to more than $92 million in FY 2011 (U.S. Natural Resources Conservation Service, 2012c). In addition to the economic incentives offered by the SGI, participating landowners also have the benefit of knowing that if the sage-grouse is listed as threatened or endangered, their efforts under the SGI will comply with the ESA (though participation does not by itself offer permits for incidental take or protection similar to a Candidate Conservation Agreement with Assurances). Although potentially effective at conserving sage-grouse populations and habitat on private lands, incentive-based conservation programs that fund the SGI generally require reauthorization from Congress under subsequent Farm Bills, and therefore these funding streams are potentially variable as they are subject to the political process.

The NRCS is working to implement SGI conservation measures on private lands that address many of the threats to sage-grouse identified in the 2010 Listing Decision. Many of those threats, including fragmented landscapes and urban expansion, overgrazing, and conifer encroachment are also threats to sustainable ranching (U.S. Natural Resources Conservation Service, 2012c). Conversely, intact landscapes, an abundance of perennial grasses and forbs, invasive species management, and well-designed grazing plans benefit both sage-grouse and promote sustainable ranching (U.S. Natural Resources Conservation Service, 2012c).

Across the range, application of SGI conservation standards, including improved grazing systems, fence modification and removal, tree removal, and conservation easements vary from State to State. Grazing is the most widespread land use across the sagebrush biome (Connelly and others, 2004) and through the SGI, NRCS is working with landowners to implement grazing practices that, among other benefits to the species, increase cover in seasonal habitats (U.S. Natural Resources Conservation Service, 2012a). Nearly 415,000 acres (1,680 km^2) in Wyoming have (or are under contract to receive) some form of improved grazing system that could support increased hiding cover (U.S. Natural Resources Conservation Service, 2012a). A component of grazing management, pasture fencing, has created a variety of threats to sage-grouse, such as mortality from collisions, increased predation due to perch sites and corridors, and habitat fragmentation (Call and Maser, 1985; Braun, 1998; Oyler-McCance and others, 2001; Beck and others, 2003; Knick and others, 2003; Connelly and others, 2004). Nearly 625 miles (1006 km) of fences were constructed annually from 1996 to 2002 in the sage-grouse range with most being constructed in Montana, Nevada, Oregon, and Wyoming (Connelly and others, 2004). Through the SGI program, participants have agreed to remove or mark nearly 350 miles (563 km) of high-risk fence (U.S. Natural Resources Conservation Service, 2012a). In Idaho, a recent study demonstrated that fence marking can lead to reduced sage-grouse collisions (Stevens and others, 2011).

SGI has two particular approaches to restoring sagebrush habitats that have been degraded or modified. NRCS is working with landowners to remove juniper and other expanding conifers from valuable habitats. For example, 54,626 acres (405 km^2) of juniper and pine have already been treated in Oregon (MZs IV and V; table 27). Urbanization and conversion of habitat to agriculture, at the other end of the habitat change spectrum, have caused habitat loss and fragmentation across the Western United States, which has been determined to be a “key cause, if not the primary cause, of the decline of sage-grouse populations” (U.S. Fish and Wildlife Service, 2010b). Conservation easements are one important approach to creating and maintaining large, intact sagebrush communities (U.S. Natural Resources Conservation Service, 2012a). At this time, NRCS has secured conservation easements on 208,023 acres (840 km^2) across the sage-grouse range (U.S. Natural Resources Conservation Service, 2012a) with the largest percentage of easements occurring in Wyoming (120,706 acres [490 km^2]), Montana (42,191 acres [171 km^2]), and Idaho (21,434 acres [87 km^2]) (U.S. Natural Resources Conservation Service, 2012a).

Farm Service Agency: Conservation Reserve Program

Similar to the incentive-based programs that fund the SGI, the Conservation Reserve Program (CRP) is a program administered by the USDA Farm Service Agency (FSA, U.S. Farm Service Agency, 2010). CRP lands are generally taken out of agricultural production and planted with perennial vegetative cover. Generally, contracts under the CRP program run for 10–15 years (U.S. Farm Service Agency, 2010). Conversion of sagebrush to agriculture influences the ability of sagebrush-dominated landscapes to support sage-grouse through direct habitat loss and fragmentation (Connelly and others, 2004). CRP fields have provided valuable habitat in Washington (Schroeder and Vander Haegen, 2006), but the value of these lands to sage-grouse across its entire range has not been demonstrated (Stiver and others, 2006b). Launched in 2008, State Acres for Wildlife Enhancement (SAFE) is a program within CRP designed to “address state and regional high-priority wildlife objectives” (U.S. Farm Service Agency, 2008). Several States across the sage-grouse range have directed SAFE efforts toward enhancing sagebrush habitat. In Colorado, SAFE project partners hope to enroll 12,600 acres (51 km^2) in CRP to restore and enhance habitat for several species of grouse, including sage-grouse. Montana and North Dakota are each aiming to enroll 1,000 acres (4 km^2) in SAFE to restore cropland to sagebrush habitat to benefit sage-grouse and other sagebrush obligate birds. South Dakota is looking to add 500 acres (2 km^2) to SAFE for the same purpose. Lastly, the SAFE program in northeast Wyoming is working to add 10,000 acres (40 km^2) to restore critical habitat by converting cropland to perennial plant communities (U.S. Farm Service Agency, 2008).

Other Federal Agencies

In addition to BLM (Department of Interior [DOI]) and the Forest Service (USDA, USFS), the United States Departments of Defense (DOD), Energy (DOE), and other Interior Bureaus (DOI, including USFWS, National Park Service [NPS], and Bureau of Indian Affairs [BIA]) manage publically owned lands across sage-grouse range, and many of these lands have use restrictions that will also help support sage-grouse (table 28, fig. 30). Although BLM and USFS manage most of the sagebrush and sage-grouse habitats—other entities and agencies, combined, manage only 5 percent of sagebrush lands in the United States (Stiver, 2011)—cooperative management strategies may have local impacts or benefits and lands managed for other specified purposes remain part of distribution and management of the sage-grouse across the landscape.

Fish and Wildlife Service, National Park Service, and Other Federal Designations

The USFWS directly manages only 1 percent of sage-grouse habitats as part of the National Wildlife Refuge System (Knick and Connelly, 2011b). Refuges are administered under the National Wildlife Refuge Administration Act of 1966 (16 U.S.C. §668dd–668ee), as amended, for the purpose of “conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources.” Several refuges within the range are currently revising their Comprehensive Conservation Plans (CCPs) as required by the 1997 National Wildlife Refuge Improvement Act. For instance, Hart Mountain National Antelope Refuge, which consists of 277,893 acres (1,125 km^2) of sagebrush-steppe in Lake County, Oregon, published a Notice of Intent in the Federal Register to revise its CCP in May 2012 (U.S. Fish and Wildlife Service, 2012,). The Notice of Intent identifies key issues to be analyzed in the CCP, many of which can benefit the refuge’s sage-grouse population: the impact of fire and juniper encroachment on the refuge’s sagebrush habitat, invasive species control, and land protection and planning to reduce habitat fragmentation (U.S. Fish and Wildlife Service, 2012). Sheldon National Wildlife Refuge, which encompasses 575,000 acres (2,327 km^2) of sagebrush-steppe in northwest Nevada, issued its Draft CCP in 2011 (U.S. Fish and Wildlife Service, 2011). Sage-grouse conservation is a major component of the CCP, which calls for, among other actions, restoration of sagebrush and riparian habitats through removal of all wild horses within the refuge,

Table 28. Summary of areas managed for conservation and (or) protection* across Management Zones (MZ) by acres of preliminary priority and preliminary general habitat (PPH and PGH, respectively).

		PPH		PGH		
Management Zone Entity	**SG Habitat (acres)**	**Area (acres)**	**Area (%)**	**SG Habitat (acres)**	**Area (acres)**	**Area (%)**
MZ I–GP	**11,636,400**	**364,800**	**3.13**	**34,663,000**	**811,000**	**2.34**
BLM	2,994,300	68,600	2.29	4,524,900	103,900	2.30
Forest Service	292,400	100	0.03	515,300	0	0.00
Tribal and Other Federal	219,700	91,400	41.60	2,427,700	373,700	15.39
Private	7,132,500	195,700	2.74	24,682,800	315,800	1.28
State	995,600	9,000	0.90	2,498,400	17,600	0.70
Other	1,900	0	0.00	13,900	0	0.00
MZ II and VII–WB & CP	**17,476,000**	**624,700**	**3.57**	**19,200,200**	**1,068,300**	**5.56**
BLM	9,021,200	241,300	2.67	9,012,500	511,100	5.67
Forest Service	162,000	2,500	1.54	452,500	46,800	10.34
Tribal and Other Federal	784,000	93,300	11.90	1,354,600	105,700	7.80
Private	6,233,900	217,100	3.48	7,394,800	358,900	4.85
State	1,244,800	44,000	3.53	979,800	41,400	4.23
Other	30,100	26,500	88.04	6,000	4,400	73.33
MZ III–SGB	**10,028,500**	**295,600**	**2.95**	**3,970,100**	**191,500**	**4.82**
BLM	6,309,400	170,900	2.71	3,199,800	130,800	4.09
Forest Service	1,236,200	93,900	7.60	356,200	56,200	15.78
Tribal and Other Federal	260,800	11,000	4.22	29,100	3,700	12.71
Private	1,836,200	12,900	0.70	384,800	500	0.13
State	385,900	6,900	1.79	200	200	100.00
MZ IV–SRP	**21,930,600**	**1,760,600**	**8.03**	**10,958,500**	**1,181,600**	**10.78**
BLM	13,710,700	1,510,700	11.02	4,928,200	741,400	15.04
Forest Service	1,613,800	26,600	1.65	1,113,500	3,000	0.27
Tribal and Other Federal	633,600	76,000	11.99	522,500	254,800	48.77
Private	4,890,200	124,800	2.55	3,516,700	164,300	4.67
State	1,019,400	22,500	2.21	846,200	16,600	1.96
Other	62,900	0	0.00	31,400	1,500	4.78
MZ V–NGB	**7,097,200**	**2,113,400**	**29.78**	**5,808,000**	**1,050,300**	**18.08**
BLM	5,117,500	1,400,900	27.37	4,196,700	955,900	22.78
Forest Service	62,200	0	0.00	114,900	100	0.09
Tribal and Other Federal	717,100	695,700	97.02	101,800	74,900	73.58
Private	798,000	11,700	1.47	1,199,000	13,400	1.12
State	64,900	2,900	4.47	115,800	5,300	4.58
Other	337,500	2,200	0.65	79,800	800	1.00

*Data Sources: National Conservation Easement Database; USGS Protected Areas Database (PAD-US); BLM NLCS, ACECs, and Wilderness and USFS Wilderness. Small differences between individual entity totals and MZ summary values may exist due to rounding of estimates during calculations.

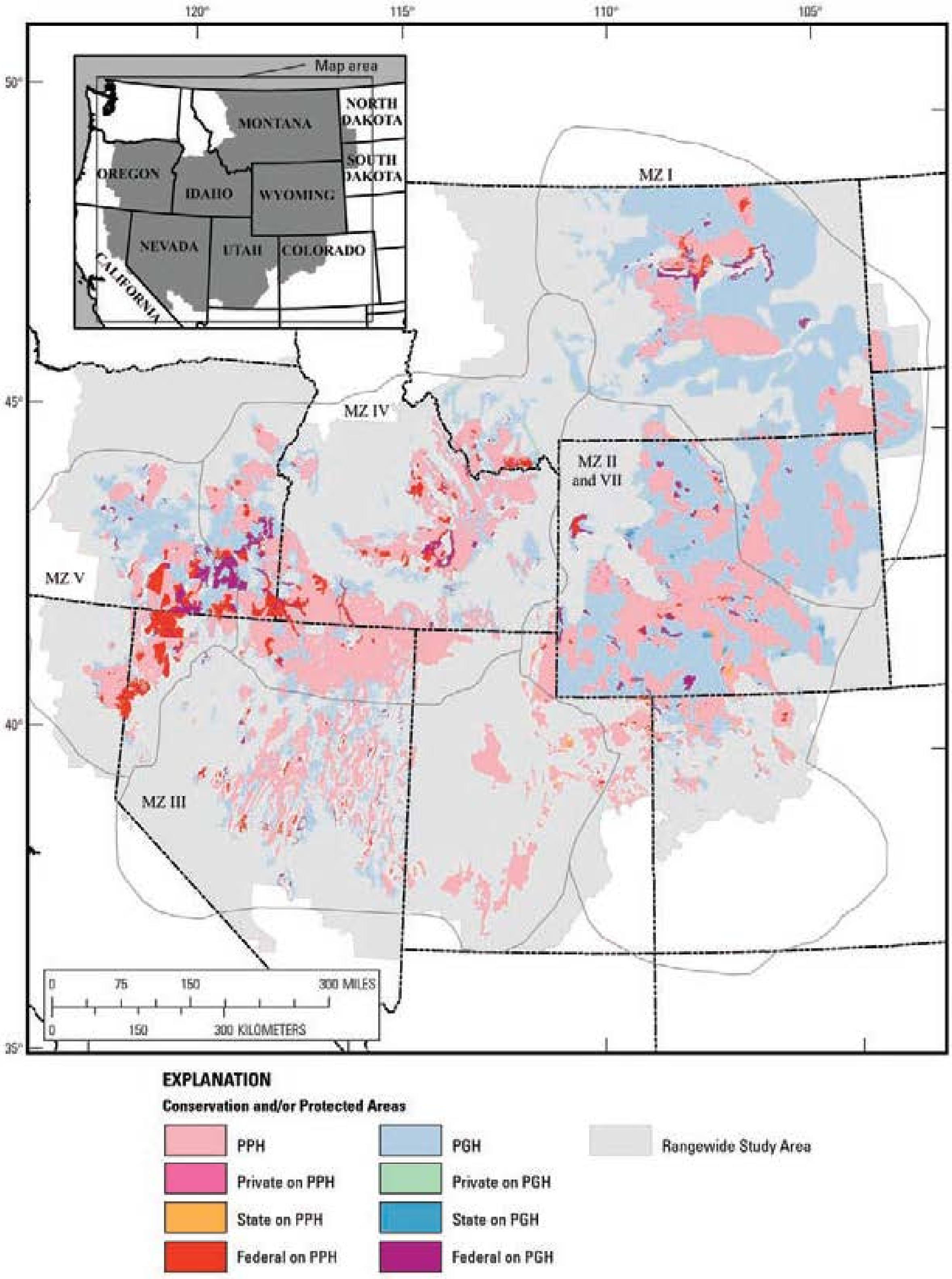

Figure 30. Overlap of Federal, State, and private (includes Non-government Organizations) conservation areas within preliminary priority and preliminary general habitats (PPH and PGH, respectively).

aggressive reduction of encroaching juniper, and control of invasive species, namely cheatgrass (*Bromus tectorum*; U.S. Fish and Wildlife Service, 2011). Again, where BLM or USFS administered lands border National Wildlife Refuges, there exists the potential for collaborative efforts that may have localized benefits to sage-grouse populations.

Several units within the National Park System are also planning for sage-grouse and sagebrush conservation. The City of Rocks National Reserve (CIRO, which is co-managed by the Idaho Department of Parks and Recreation) and Craters of the Moon National Monument and Preserve (CRMO, which is co-managed by the BLM) are located in the Upper Columbia River Basin in southern Idaho (MZ IV). Additionally, habitat selection studies have been conducted on the Jackson Hole sage-grouse population in and around Grand Teton National Park (Chong and others, 2011), a small, but high-profile population in Wyoming.

CRMO encompasses roughly 737,700 acres (2,985 km^2) in south-central Idaho, of which 70 percent is designated as either Wilderness Study Area or Wilderness (U.S. National Park Service and Bureau of Land Management, 2006). Observations by the Idaho Department of Fish and Game indicate a 36 percent decrease in the number of sage-grouse leks in the last quarter century with 53 known leks recorded on BLM-administered lands within the monument (U.S. National Park Service and Bureau of Land Management, 2006). As described in the CRMO General Management Plan (2006), the agencies intend to prioritize vegetation restoration projects relative to sage-grouse populations (including enlarging and connecting habitats), as well as implement protective measures from the Idaho Sage-grouse Advisory Committee's Conservation Plan, including use restrictions where needed near occupied leks (U.S. National Park Service and Bureau of Land Management, 2006). CIRO is currently in the process of revising its General Management Plan.

Wilderness designations may also play a role in sustaining sage-grouse populations and conserving their habitat, however very few Wilderness areas contain sagebrush (table 28); expansion to include current roadless areas could increase the area from about 6 percent to 9 percent of the sagebrush landscape (Crist and others, 2005). Lands designated as Wilderness must generally contain at least 5,000 acres (20 km^2) and are managed by the agency having jurisdiction over such lands before they were included in the National Wilderness Preservation System (16 U.S.C. § 1131 *et seq*.). Wilderness designations are subject to the political process because only Congress can designate Wilderness areas (16 U.S.C. § 1131 *et seq*.). Wilderness areas are characterized by the absence of motorized equipment and mechanical transport, and commercial enterprises are prohibited (16 U.S.C. § 1131 *et seq*.); therefore, they do not host many of the anthropogenic threats to sage-grouse identified in the USFWS 2010 Listing Decision, such as habitat conversion for agriculture, urbanization, infrastructure, and energy development.

Department of Defense

There are approximately 87 Department of Defense (DoD) managed facilities distributed across the sage-grouse range with various operations and intensity of use among and within those facilities (Connelly and others, 2004). Because human access to many military installations is limited, these lands present an opportunity to conserve sage-grouse habitat; however, with only 26 percent (6,815 km^2 [1.7 million acres]) of DoD managed lands being sagebrush dominated, they represent approximately 0.01 percent of the currently estimated sage-grouse range (670,000 km^2 [165.5 million acres]). Seven military installations have confirmed sage-grouse populations, five of which are under the control of the Army: Dugway Proving Ground (Utah), Sheridan Training Area (Wyo.), Camp Guernsey (Wyo.), Hawthorne Army Depot (Nev.), and the Toole Army Depot (Utah). Two Air Force Bases (AFB) manage for known populations: Nellis AFB in Nevada and Mountain Home AFB, which administers the Saylor Creek and Juniper Butte Ranges in Idaho (U.S. Department of Defense and U.S. Fish and Wildlife Service, 2006).

At sites where military training exercises occur, such activities are generally destructive by their nature (Connelly and others, 2004) and may have substantial effects on habitats including the spread of exotic species, the potential for soil erosion, and the possibility of reduced ecosystem productivity from tracked and wheeled vehicle maneuvering, as well as fires from ordnance impacts (Belcher and Wilson, 1989; Shaw and Diersing, 1990; Watts, 1998). Obvious land-use impacts were evident on approximately 17 percent of the military lands surveyed by the Land Condition Trend Analysis, leaving substantial portions of some facilities available for conservation and management of native species (Knick and others, 2011).

Although the land-use and conservation activities of DOD may have important local effects on the distribution of sage-grouse habitats (including effects on disturbance regimes) as well as some populations, they represent only a small portion of the species' range and therefore a small component of the conservation effort. When DOD facilities with sagebrush habitats fall within (partially or entirely) or adjacent to BLM or USFS planning and management units, then actions and planning that address sage-grouse conservation may benefit from recognition of resources, authorities, and activities associated with DOD lands that may benefit or harm sage-grouse in the planning process. Cooperation and collaboration with DOD, and other agencies that affect land-use patterns and habitat conditions (such as, Bureau of Reclamation, Department of Energy, USFS), during regional planning processes is important to ensure sound management and efficient use of public resources across political boundaries.

Department of Energy

The Idaho National Laboratory (INL) site consists of 2,305 km^2 (570,000 acres) in the Upper Snake River Plain of southeastern Idaho (Whiting and Bybee, 2011) of which 115 square miles was designated as the Sagebrush-Steppe

Ecosystem Reserve in July 1999 by the Secretary of Energy (INL Campus Development Office and North Wind, Inc., 2011). The INL site is home to several sage-grouse populations and hosts numerous sage-grouse leks (INL Campus Development Office and North Wind, Inc., 2011; Whiting and Bybee, 2011). The INL includes most of the same issues found on the larger sage-grouse range. Wildland fires are relatively common on the site and an on-site fire department provides wildfire management in cooperation with the BLM and local authorities (INL Campus Development Office and North Wind, Inc., 2011). BLM administers permits to graze cattle and sheep on up to 340,000 acres (1,375 km^2) of the INL (INL Campus Development Office and North Wind, Inc., 2011). Nearly six percent of INL (approximately 34,000 acres, [138 km^2]) consists of public roads and utility rights of way (INL Campus Development Office and North Wind, Inc., 2011). Other infrastructure includes an extensive power delivery system, including substations and a 62 mi (100 km) (60 miles of which are above ground) transmission loop (INL Campus Development Office and North Wind, Inc., 2011).

From 1978 to 1980, fixed-wing aircraft and four-wheel-drive surveys identified 59 sage-grouse leks on or near the INL (Connelly, 1980). According to these data, it was determined that the INL populations were stable or increasing (Connelly, 1980). Monitoring of the INL sage-grouse populations was sporadic until a recent study collected data on lek attendance, activity, and distribution within the INL during the springs of 2009 and 2010 (Whiting and Bybee, 2011). Upon revisit, the number of active sage-grouse leks within the INL was less than half of historical leks (Whiting and Bybee, 2011), although uncertainty associated with historic data and dynamic populations may confound these data. The authors concluded that the INL likely follows the regional trend of sage-grouse with populations declining in the 1980s and 1990s but stabilizing at the current low levels during the past decade (Garton and others, 2011; Whiting and Bybee, 2011). Annual spring surveys will be conducted on the INL to ultimately produce an index of population trends at the site (Whiting and Bybee, 2011).

State and Local Working Group Conservation Efforts

States generally have broad authority to manage wildlife within their borders. All States within the range of sage-grouse have laws addressing wildlife conservation, but such laws are general in nature without specific mention of sage-grouse (U.S. Fish and Wildlife Service, 2010b, p. 13,974); nevertheless, States and local working groups (LWGs) across the sage-grouse range have developed conservation plans that direct management efforts at the State and regional level (Stiver, 2011). Although such plans generally provide a management framework rather than regulations, they are a valuable mechanism for implementing efforts that conserve sage-grouse populations and their habitat.

In addition to developing State and LWG conservation strategies, States can affect sage-grouse conservation by several other means. Governors of several States have issued executive orders (White and others, 1997) to offer greater regulatory force to sage-grouse conservation. Moreover, in addition to State fish and wildlife agencies, other State-level agencies may have authority to regulate activities that are threats to sage-grouse. This includes State agencies or commissions responsible for regulating oil and gas developments or siting power transmission lines. Lastly, all 10 States within the sage-grouse range own State trust lands, which each State manages for the benefit of various trustees (U.S. Fish and Wildlife Service, 2010b). Trust lands consist of two sections per township (four sections in Utah) and therefore usually represent a checkerboard of lands scattered around each State (Culp, 2005). Nevertheless, the cumulative area of State trust lands can be large—Montana's trust lands include 5 million acres (20,230 km^2) of surface property, Utah holds 3.5 million (14,150 km^2) surface acres in trust, Wyoming and Colorado each have about 3 million (12,140 km^2) surface acres, and Idaho holds about 2.5 million acres (10,100 km^2) in trust (Culp, 2005). States generate revenue on State trust lands through various activities—disposition or leases for residential or commercial development, timber harvesting, mineral development, agricultural uses and recreation including fishing and hunting (Culp, 2005). These lands represent a potentially important component of long-term sage-grouse conservation; however, there are limitations due to the scattered distribution of these lands (reducing the potential benefit unless coordinated with management efforts on adjacent lands) and potential change in ownership and management due to the fiduciary trust responsibilities.

The following section presents a brief overview of conservation efforts within each State and, where applicable, the major threats those efforts seek to mitigate. A complete description of management efforts in each State is out of the scope of this report, and such information is available from individual States and LWGs. In 2011, the Western Governors Association released an inventory of State and local conservation initiatives for sage-grouse (Western Governors' Wildlife Council, 2011).

California/Nevada

In August 2000, then Nevada Governor Kenny Guinn appointed a Sage-Grouse Conservation Team that developed a conservation strategy for sage-grouse (Nevada Sage-Grouse Conservation Team, 2004). Through collaboration with the California Department of Fish and Game, the strategy was later expanded to include eastern California and LWGs in each State were identified and tasked with designing practical solutions for their respective region. The seven LWGs (including a Bi-State Planning Group) developed local conservation plans, which were submitted to the Governor's Team for synthesis into a conservation plan for Nevada and eastern California (Nevada Sage-Grouse Conservation Team, 2004).

The Greater Sage-Grouse Conservation Plan for Nevada and Eastern California prioritizes conservation efforts within both States. Immediate priorities identified include a comprehensive spatial analysis to determine those areas that support large populations of sage-grouse and are at high risk for wildfire or invasion of cheatgrass (Nevada Sage-Grouse Conservation Team, 2004). In 2012, the Nevada Department of Wildlife published its sage-grouse habitat categorization analysis, which delineated five classes of sage-grouse habitat ranging from essential/irreplaceable habitat to unsuitable habitat, to direct mitigation and conservation efforts within Nevada and California (Nevada Department of Wildlife, 2012).

Other top priorities identified by the Governor's Team include wildfire pre-suppression treatments, fire control and vegetation management. The average fire size in the Southern Great Basin (MZ III) increased from 1980 to 2007 (U.S. Fish and Wildlife Service, 2010a). As much as 80 percent of the land within the Great Basin ecoregion (MZs III, IV, and V) is at risk of being displaced by cheatgrass in the next 30 years, and an estimated 35 percent of sagebrush in the region is at high risk of displacement by pinyon-juniper in the same time (Connelly and others, 2004).

The Nevada Department of Wildlife, in cooperation with various Federal agencies, has implemented numerous conservation projects to confront these threats dedicating more than $2 million and totaling nearly 69,000 treated acres (280 km^2) on private lands and lands administered by Federal agencies from 2001 to 2009. These projects include pinyon-juniper removal, weed treatments, and fire rehabilitation (Nevada Department of Wildlife, 2011). More recently, Governor Brian Sandoval issued an Executive Order forming the Governor's Greater Sage-Grouse Advisory Committee to recommend policies for the protection of sage-grouse (Nevada Executive Order, Mar. 30, 2012). The recommendations, released in July 2012, provide management strategies to achieve "no net loss" for controllable activities and aggressive pre-suppression, initial attack, and restoration for uncontrollable events (Nevada Greater Sage-Grouse Advisory Committee, 2012).

Colorado

Colorado's Greater Sage-Grouse Conservation Plan (2008) prioritized threats across each of the State's six sage-grouse populations: Meeker-White River, Middle Park, North Park, northern Eagle-southern Routt Counties, northwest Colorado, and Parachute-Piceance-Roan (Colorado Greater Sage-Grouse Steering Committee, 2008). Urbanization and associated habitat fragmentation are substantial threats to sage-grouse in portions of the sage-grouse range in Colorado (U.S. Fish and Wildlife Service, 2010a). The Colorado Division of Wildlife, through its Habitat Protection Program, secured 40,000 acres (162 km^2) of sage-grouse habitat through land purchases and conservation easements (Western Governors' Wildlife Council, 2011). Such actions are part of the State's strategy to mitigate what the USFWS described as the "key cause, if not the primary cause, of the decline of sage-grouse populations," namely habitat fragmentation (U.S. Fish and Wildlife Service, 2010a). Within these recognized habitat regions, urbanization is occurring most heavily in Middle Park and northern Eagle-southern Routt Counties. Conservation easements benefiting sage-grouse total 8,883 acres (36 km^2) and 2,430 acres (10 km^2) of occupied habitat in the Middle Park and northern Eagle-southern Routt County areas, respectively (Colorado Greater Sage-Grouse Steering Committee, 2008).

Oil and gas development has expanded at a rapid rate in portions of Colorado (threats to sage-grouse associated with such development are presented in previous sections of this report). Applications for permits-to-drill increased 50 percent between 2004 and 2005 and increased by an additional 35 percent from 2005 to 2006. In 2005, 99 percent of these permits were for new wells. Current oil and gas development is concentrated in northwest Colorado (described as "moderate; increasing exponentially") and Parachute-Piceance-Roan ("high; increasing exponentially") areas (Colorado Greater Sage-Grouse Steering Committee, 2008). In 2009, then Colorado Governor Bill Ritter signed into law regulations to address sage-grouse conservation applicable to the Colorado Oil and Gas Conservation Commission. Pursuant to an MOU among that Commission, BLM, and USFS, these regulations apply to oil and gas permitting decisions on both private and Federal land within the State (Interagency MOU, 2009; U.S. Fish and Wildlife Service, 2010a). The new regulations require operators seeking a permit to drill to first determine if the proposed development occurs within "sensitive wildlife habitat" (C.R.S. § 34-60-128 and COGCC Rules and Regulations § 1201). Operators are required to consult with the Colorado Division of Wildlife to avoid impacts on wildlife resources and mitigate any unavoidable impacts (COGCC Rules and Regulations § 1202a).

Idaho

Wildfire, infrastructure, and proliferation of invasive species were the three most pressing threats (in order of priority) to sage-grouse in Idaho as determined by a panel of leading scientists in 2006 (Idaho Sage-Grouse Advisory Committee, 2006). The Idaho Sage-Grouse Conservation Plan contemplates the full spectrum of threats; several are addressed here. On March 9, 2012, Idaho Governor C.L. Otter issued Executive Order 2012-02, which established a 15-member Sage-Grouse Task Force to provide recommendations on the long-term viability of the species within the State.

As in other States, the potential for wildfire to negatively affect vast acres of sage-grouse habitat represents a substantial threat to the persistence of the species and remains a top management priority in Idaho (Idaho Sage-Grouse Advisory Committee, 2006). Spread and establishment of cheatgrass and other annuals have contributed to reduced fire-return intervals in portions of the Snake River Plain (Young and others, 1987; Connelly and others, 2004). The Governor's Sage-Grouse Task Force recommended identifying perennial grasslands with the highest risk for wildfire that are most likely to benefit from fuel-break construction (Idaho Sage-Grouse Task

Force, 2012). Numerous weed and fuel-break efforts have been undertaken, and a substantial number of acres has been treated on private, State, and Federally managed lands within the State with funds from the Governor's Office of Species Conservation. The State has also focused efforts on fire restoration; several reseeding and rehabilitation projects have occurred since 2002, totaling 3,399 treated acres (13.75 km^2) (Idaho Sage-grouse Advisory Committee Technical Assistance Team, 2012).

Infrastructure is also perceived as a substantial threat to sage-grouse in Idaho. There are approximately 1,500 miles (2,414 km) of major power transmission lines within the State's sage-grouse planning areas (Idaho Sage-Grouse Advisory Committee, 2006). Including a 3.1 mi (5 km) buffer on either side of these lines expands the affected area to more than 4.5 million acres (18,200 km^2) (Idaho Sage-grouse Advisory Committee 2006). There are approximately 975 mi (1,560 km) of major paved roads (interstate, Federal, and State) within Idaho sage-grouse planning areas, which, when a 6.2-mi (10-km) buffer is considered, account for more than 6.8 million acres (27,500 km^2) of affected area (Idaho Sage-Grouse Advisory Committee, 2006). A Governor's Task Force recommended several management practices to mitigate the effects of infrastructure on sage-grouse including co-locating linear facilities, building new roads to the minimum specifications necessary, and time restrictions on construction of new facilities (Idaho Sage-Grouse Task Force, 2012).

Spatial studies reveal several large tracts of annual grasslands, totaling nearly one million acres (4,050 km^2) within Idaho's sage-grouse planning areas in south-central, southwestern, and western Idaho. The BLM manages approximately 62 percent of these identified grasslands, whereas 29 percent are under private ownership (Idaho Sage-Grouse Advisory Committee, 2006). LWGs report numerous weed control efforts across various types of land ownership within the State. As of 2011, nearly 9,300 acres (38 km^2) have been treated to control weeds (Idaho Sage-Grouse Advisory Committee Technical Assistance Team, 2012). The Governor's Task Force recently recommended best-management practices regarding invasive species control to be incorporated into land-use-plan revisions (Idaho Sage-Grouse Task Force, 2012).

Montana and the Dakotas

Energy development, grazing, and habitat conversion to agriculture are among the primary threats to sage-grouse in Montana (U.S. Fish and Wildlife Service, 2010a). Portions of two geological basins within the State are experiencing increased levels of energy development—the Powder River Basin (predominately coal-bed methane) in southeastern Montana and northeastern Wyoming and the Williston Basin in eastern Montana and the Dakotas (U.S. Fish and Wildlife Service, 2010a). The Powder River Basin serves as a link between the Wyoming Basin and central Montana sage-grouse populations; it is anticipated that this connectivity could be lost in the near future, in part, due to the intensive development in this region (U.S. Fish and Wildlife Service, 2010a). Montana's Management Plan and Conservation Strategy for Sage Grouse (2005) proposed several conservation actions to meet energy demands while minimizing effects to sage-grouse including surface occupancy restrictions (0.25 miles around existing leks), restricting noise levels near leks, and avoidance of leks and critical habitat in siting infrastructure. Notably, in 2007, the Montana Department of Natural Resources and Conservation rejected a recommendation from the State's Department of Fish, Wildlife and Parks to amend a stipulation placed on State trust land oil and gas leases to include sage-grouse protections (this amendment would have increased the no-surface-occupancy buffer radius to between 1 and 1.8 miles and included timing restrictions on lands within 4 miles from known leks). The decision cited concerns that the recommended restrictions would prevent the Department of Natural Resources and Conservation from protecting oil and gas resources under State lands from drainage by adjacent mineral owners (Montana Department of Natural Resources and Conservation Trust Land Management Division, 2007).

Although sagebrush communities in the Northern Great Plains, including Montana, likely evolved with periodic grazing, many of these rangelands were overstocked in the late 1800s and early 1900s, which altered the composition and productivity of sagebrush communities (Montana Sage-Grouse Work Group, 2005). Montana's State Plan (2005) prescribes grazing management actions that maintain and enhance sagebrush rangelands while providing for agricultural commodities. These include incentives for private landowners to help achieve sage-grouse objectives (Montana Sage Grouse Work Group, 2005). As described above, the NRCS is working with private landowners around the State to implement improved grazing systems on more than 246,000 acres (995 km^2) in the State through its SGI program (U.S. Natural Resources Conservation Service, 2012a). The Montana Department of Fish, Wildlife and Parks, through contracts with private landowners, implemented grazing standards on more than 550,000 acres (2,226 km^2) of privately owned land in the State (Montana Sage Grouse Work Group, 2005).

Large losses of sagebrush resulting from conversion to agriculture have occurred in the Great Plains MZ (MZ I). Across the State, the amount of acres converted to tilled agriculture increased annually from 2005 to 2009, with more than 25,000 acres (101 km^2) converted in that time. This threat is particularly prominent in the eastern two-thirds of the State (U.S. Fish and Wildlife Service, 2010a). Montana's State Plan reported that the State's Department of Fish, Wildlife and Parks intended to continue to negotiate conservation easements to conserve native rangelands by prohibiting subdivision and conversion to cropland. With funding through the Landowner Incentive and Upland Game Bird Programs, the Department of Fish, Wildlife and Parks anticipates protecting 183,000 acres (740 km^2) of occupied private lands from herbicide spraying, prescribed burning, and conversion to cropland (Montana Sage Grouse Work Group, 2005).

The populations at the eastern reaches of the range, in North and South Dakota, occupy a relatively small area in the western portions of both States and are known to be well-connected to populations and habitats in eastern Montana. The issues threatening these populations are the same as the threats associated with neighboring populations in southeastern Montana and northeastern Wyoming including oil and gas development. Fourteen percent of the Federal mineral estate (902,000 acres [3,550 km^2], combined) within the sage-grouse conservation area in North and South Dakota are authorized for development (U.S. Fish and Wildlife Service, 2010a). Both States have management plans that address sage-grouse conservation, and BLM habitat management is coordinated among Montana, North Dakota, and South Dakota (within a single Field Office).

Oregon

Oregon's "Wildlife Policy," codified in Section 496.012 of the Oregon Revised Statutes states "[i]t is the policy of the State of Oregon that wildlife should be managed to prevent serious depletion of any indigenous species…" Oregon's Greater Sage-Grouse Conservation Assessment and Strategy provides a framework to maintain and enhance sage-grouse in the State. It accomplishes this by combining a "core area" approach, modeled after Doherty and others (2011b) with a complementary method to estimate connectivity corridors to approximate seasonal ranges (Oregon Department of Fish and Wildlife, 2011). Once core areas were identified, various sagebrush habitats within the State were categorized based on suitability for sage-grouse, and management guidelines were recommended for each category with greater restrictions in higher value habitat (Oregon Department of Fish and Wildlife, 2011).

The Oregon conservation plan addresses many of the threats identified by the USFWS in the 2010 Listing Decision. The plan offers voluntary guidelines to mitigate each threat. Implementation of the guidelines will be directed by local Implementation Teams, consisting of Oregon Department of Fish and Wildlife personnel, Federal land management agency representatives and private entities. There are five Implementation Teams, corresponding to various BLM district boundaries within the State. Implementation Teams have initiated projects under the guidance of the State plan—from removing 90,000 acres (365 km^2) of juniper within the Burns District to treating nearly 30,000 acres (121 km^2) of invasive weeds in the Vale District (Oregon Department of Fish and Wildlife, 2011).

Utah

Four MZs divide Utah (Connelly and others, 2004) representing the State's diverse ecological and biological composition. Such variation also presents numerous threats to the State's sage-grouse populations. Utah's Sage-Grouse Planning Committee comprises members representing various backgrounds from public and private entities who prioritized threats to the species across the State. This prioritization incorporated the identification and prioritization of threats within Utah's 11 Management Areas by LWGs (Utah Division of Wildlife Resources, 2009).

State-wide, the Planning Committee identified six major threats: invasive species expansion, habitat conversion, conifer encroachment, energy development, altered fire cycles, and predation (Utah Division of Wildlife Resources, 2009). Utah's Greater Sage-Grouse Management Plan (2009) seeks to protect and maintain occupied habitat, while restoring 175,000 acres (700 km^2) of habitat by 2014. The plan provides an overall strategy for use in implementing conservation actions by LWGs. LWGs in Utah provide annual updates detailing those actions taken for specific strategies identified in each LWG plan. According to a recent report, for the Strawberry Valley Adaptive Resource Management Area, 10,223 acres (41 km^2) have been purchased within the Management Area by the Utah Reclamation and Mitigation Commission. A full discussion of the management efforts within the State is available from the Utah State University Cooperative Extension.

Wyoming

Estimates of sage-grouse populations indicate that Wyoming is home to the largest number of birds in the range of the species (U.S. Fish and Wildlife Service, 2010a). The State's sage-grouse populations face a variety of threats—intensive energy development in the Powder River and Greater Green River Basins and extensive infrastructure, including power lines, fences, and roads (U.S. Fish and Wildlife Service, 2010a). Eight LWGs around the State have completed conservation plans, many of which prioritize threats and prescribe management actions at the LWG scale.

At the State level, Wyoming Governor Matt Mead issued an executive order (Wyoming Executive Order June 2, 2011) that complemented (and replaced) several executive orders issued by his predecessor, Governor Dave Freudenthal (Wyoming Executive Order August 1, 2008 and August 18, 2010). The 2011 order further articulates the State's Core Population Area Strategy (as initially described in the 2008 executive order) as an approach to balance sage-grouse conservation and development. It provides an approach to mitigating anthropogenic disturbances to sage-grouse. The USFWS believes that Wyoming's Core Population Strategy, if extended to all landowners via regulatory mechanisms, would provide adequate protection for sage-grouse (U.S. Fish and Wildlife Service, 2010a); however, universal implementation remains uncertain due to variety in ownership and management.

Specifically, the 2011 order contains consultation requirements with the Wyoming Game and Fish Department for proposed activities requiring a State permit (Wyoming Executive Order June 2, 2011)—the Wyoming Game and Fish Department has no authority to either approve or deny the project. The order does apply to State trust lands in Wyoming covering almost 23 percent of sage-grouse habitat and contributing habitat benefiting approximately 80 percent of the estimated breeding population in the State (U.S. Fish and Wildlife Service, 2010a). The executive order does not restrict activities with a defined project boundary existing prior to August 1, 2008. All proposed activities are evaluated through a Density-Disturbance Calculation Tool to determine if the project would exceed recommended density-disturbance thresholds. Additionally, the 2011 order includes stipulations to be included in such permits with varying restrictions depending on whether the proposed development activity occurs within or outside delineated Core Population Areas (Wyoming Executive Order June 2, 2011). Wyoming's Industrial Siting Council (within the State's Department of Environmental Quality), which permits large development projects on all lands within the State, regardless of ownership, is subject to the terms of the executive order. This could offer sage-grouse considerable regulatory protection when considering large wind energy and other development projects within Wyoming (U.S. Fish and Wildlife Service, 2010a).

V. Risk, Policies, and Actions: Assessment of Dominant Threats and Potential Interactions within Management Zones

Increasing human populations with concurrent increases in demand for resources, dynamic ecological processes, fire and fire effects, highly variable climate conditions, and potential synergistic feedbacks with ecological processes such as the distribution of invasive plant species will combine to increase disturbance and disruption of the sagebrush ecosystem. These interactions, and the subsequent distribution of habitats, represent the dynamic playing field where management and planning may influence changes to sagebrush-dominated landscapes throughout the Western United States, and this complicated framework will continue to present challenges for conservation of sage-grouse populations and habitats into the future (Knick and others, 2011). Projections for urban and exurban (suburban and rural subdivisions) growth across the Western United States mirror national projections, and some urban-growth areas are outpacing national trends (see U.S. Census Bureau Web site at *http://www.census.gov/population/www/projections*). Fences, power transmission lines, communication towers, and roads are ubiquitous, albeit not evenly distributed, across sage-grouse range, and these structures have known, or sometimes presumed, effects on sage-grouse populations. Conversion of land for crops, livestock, resource extraction, and domestic expansion has long been a basic tenant of western civilization, and though the land has provided these essential goods and services, alteration of resource conditions, wildlife habitats, and ecosystem function creates a critical trade-off between land use and conservation of resources and natural heritage values (Defries and others, 2004). Further, industrial development of public and private lands, including traditional fossil fuels, tar sands, and coal bed methane along with expansion of "renewable" energy sources such as wind, solar, and geothermal and the infrastructure required to support these operations represent widespread, unevenly distributed, pressures and impacts on sagebrush ecosystems and sage-grouse populations. This apparently philosophical or sociological debate regarding the balance among different land uses may seem peripheral to sage-grouse conservation; however, the management of these competing uses also involves fundamental, practical issues that affect the successful conservation of sage-grouse and sagebrush ecosystems. Thus, long-term challenges for regional planning, local habitat management, and wildlife conservation may be summarized by our ability to understand and manipulate a complicated and changing landscape for a balance among multiple uses and demands of some citizens and protection of common heritage and public interests including functioning ecosystems and wildlife habitat.

Sage-grouse are currently widespread (although in some areas densities are low), and relatively large areas continue to provide essential sagebrush habitats for the species; thus, long-term conservation of sage-grouse populations should be possible (Connelly and others, 2011b). The distributions of habitats, species, and human land uses are notably heterogeneous across large landscapes, and understanding the relations and processes that create these patterns, correlations, and aversions will assist in long-term planning. By helping to identify risks to habitat and resource conservation success, control and mitigation activities can be efficiently implemented by management agencies to reduce impacts and insure resiliency, and ultimately, to protect and conserve our natural heritage and natural resources for future generations. Rather than any single source of habitat degradation, the cumulative and synergistic impact of multiple disturbances, continued spread and dominance of invasive species, and increased impacts of land use continue to have the most significant influence on the trajectory of sagebrush ecosystems and sage-grouse populations (Connelly and others, 2011b). Future patterns of land use, combined with *effective* restoration and management, may improve, or degrade, the remaining sage-grouse ranges, but natural dynamics and unforeseen stochasticity promise to add complexity to future plans and landscapes, and these interactions are more difficult to control. Finally, population and habitat dynamics may be exaggerated for sage-grouse due to their strong affinity (obligate relation) with extensive, intact, and well-functioning sagebrush ecosystems, and because habitat limitations may magnify the effects of population stressors such as disease and disturbances such as wildfires.

Actions and Activities

The numerous efforts undertaken to identify threats to sage-grouse cumulatively suggest that invasive species, wildfire, grazing management and energy development—with the relative importance of each varying throughout the range of the species—pose the greatest risk to long-term conservation of sage-grouse (Connelly and others, 2011b). The Greater Sage-Grouse Comprehensive Conservation Strategy (GSGCCS; Stiver, 2011b) ranked potential habitat issues by region (eastern and western portions of the sage-grouse range) in order of immediacy, and the Greater Sage-Grouse Conservation Objectives Team: Final Report (2013) discusses details of populations which are not addressed here.

In the western portion of the range (especially MZs III, IV, and V), control of fire (removal from management, reduced human ignitions, and suppression of wildfires) and management of dispersed recreation have been identified as regional priorities for reducing disturbance to habitats and populations. Combating habitat degradation due to invasive plants was also deemed critical, and the current wide distribution and dominance by several invasive species (for example, cheatgrass and Medusahead) require risk assessment, prioritization, and strategic planning to focus funds and efforts to strategically protect and improve habitats. A combination of regional planning to determine the highest value areas, followed by local planning and implementation, will likely be required to address these species, which both degrade local habitats and agricultural productivity. These species are widespread across the region with severe infestations providing extensive seed sources and the necessity to manage across vast areas, multiple management units, and mixed ownership and administration. Manipulation of livestock grazing rotations and intensity to support conservation objectives for habitat condition and invasive plant control was identified as an important tool for managers throughout western portions of the sage-grouse range. In addition, increasing land use on, and around, public lands increases displacement of sage-grouse due to noise and activities; consideration of both near- and long-term habitat impacts of dispersed recreation and urban and exurban development were also identified as issues requiring attention. Trends in resource conditions and utilization, assessed locally and adapted seasonally, will be the most likely actions to affect short-term population trends when they are supported by regional planning and policy to reduce industrial impacts, eliminate new developments in priority habitats, and promote intact sagebrush ecosystems providing the necessary structure to substantiate local actions.

Similarly, on the eastern portion of the range (MZs I, II, and VII), invasive plant management and fire suppression remain important components of the conservation strategy. However, the GSGCCS (Stiver and others, 2006a) identified the reduction of impacts from the development of nonrenewable energy, and the support infrastructure (pipelines, roads, and structures) necessary for these developments, as top regional priorities for addressing declining sage-grouse populations. The potential for impacts across scales makes careful and deliberate planning at local *and* regional scales relevant to local populations. Consistent criteria for locating energy corridors, facilities, and infrastructure with minimal impacts to intact sagebrush communities and associated sage-grouse populations may incur benefits by concentrating activities and directing them away from the most sensitive areas and populations. To be useful and accurate, monitoring effectiveness of restoration and remediation projects may be coupled to landscape accounting for cumulative effects to insure treated and restored lands have required habitat values before additional sagebrush habitat is disturbed.

Historically, sagebrush was common across the range of sage-grouse (all MZs), but it was least common on the Colorado Plateau (eastern half of MZ III), Columbia Plateau (MZ VI), and Great Plains (MZ I). Historically and currently, sagebrush is most common in the northern Great Basin (MZ V) and eastward across the sagebrush-steppe found in the Snake River Plain and the Wyoming Basin (MZs II and IV); however, as previously noted, the best big sagebrush ecological sites (those with deep loamy soils) have been largely converted to agriculture. Because sage-grouse depend on sagebrush through all seasons with consistent selection for areas with more sagebrush canopy cover (Johnson and others, 2011), landscape-scale management for greater extent and connectivity of sagebrush communities and management and monitoring to maintain suitable shrub and herbaceous cover within that matrix are basic defining goals to direct conservation in all regions. Lek trends across the species' range are positively associated with sagebrush cover at multiple scales; functioning sagebrush ecosystems that provide cover and forage during all seasons are a necessary condition for viable sage-grouse populations (Johnson and others, 2011). Treatments that reduce sagebrush cover in the near-term are not recommended but may be successful if carefully prescribed within a region possessing "excess sagebrush cover" and with reasonable expectations for realization of increased sagebrush cover and habitat quality in the future (likely 25 years or more). Importantly, the risk of wildfire, estimated using fuel models, is pronounced across several MZs with the greatest risk in the Great Basin region (MZs III, IV, and V) due largely to the influence of cheatgrass (see figs. 26 and 27*A*); however, large portions of other regions (MZs I and II) are also projected to be at high risk. Fuel mitigation while maintaining and sustaining sagebrush habitat values across large landscapes will remain an important and challenging balance for habitat managers into the future.

Management Zone Summaries

MZ I—Northern Great Plains

Management Zone I consists of four sage-grouse populations, each encompassing relatively large regions: the Dakotas, northern Montana, Powder River Basin, and Yellowstone watershed populations (Garton and others, 2011). Predicted population trends indicate that populations in this MZ have an 11 percent chance of falling below 200 males by 2037, and a 24 percent chance of falling below 200 males by 2107 (Garton and others, 2011). A majority (66 percent) of the sagebrush landscape in this MZ is privately owned; however, sage-grouse leks in the region remain relatively well connected (Knick, 2011; Knick and Hanser, 2011). Because a majority of the sage-grouse habitats within MZ I are privately owned, current options for habitat conservation—for example, conservation easements and farm bill programs that can only be applied to private lands—are a viable option for effective sage-grouse conservation throughout the region. Some CRP lands may create habitat refugia within converted landscapes when they include sagebrush cover; enrollment of 17 percent of an agricultural landscape in eastern Washington succeeded in reversing short-term population declines (Schroeder and Vander Haegen, 2011). Cover and productivity of native rangelands, including silver sagebrush (*Art. cana*) and big sagebrush (*Art. tridentata*), are essential for effective conservation of sage-grouse in this region. Limited sagebrush cover (naturally, due to environmental gradients favoring grassland systems) coupled with historic agricultural uses and current energy-production infrastructure make natural and induced habitat limitations a fundamental, limiting factor for local sage-grouse populations in this region.

Major threats to sage-grouse habitats and populations occurring across populations in this MZ include oil and gas developments and conversion of native rangeland to crops (Conservation Objectives Team, 2013). Regional assessments estimated that 7.2 percent of priority and general habitats in MZ I are directly influenced by agricultural development, and >99 percent of these habitats are within 4.3 mi (6.9 km) of agriculture (table 4). Less than 1 percent of sage-grouse habitats are directly influenced by a natural gas or oil well; however, nearly 60 percent of the designated habitats lie within 11.8 mi (19 km) of a well (table 11, fig. 15)—the estimated effects area (Johnson and others, 2011; Taylor and others, 2012). More than 6.3 million acres (25,500 km^2, 14 percent) of sage-grouse habitat is currently leased for the development of Federal fluid minerals (table 13). Additionally, most sage-grouse habitats within the MZ have the potential to be influenced by mining and (or) energy development (figs. 21 and 22), although current coal and mineral developments directly influence less than 1 percent of the lands in the region (tables 16 and 17). BLM managed grazing allotments "not meeting land health standards for wildlife with grazing as the causal factor" constitute 2 percent of MZ I and are not widespread throughout the region (fig. 28); however, most of the sage-grouse habitats in MZ I are privately owned and were not addressed in this analysis. Inappropriate livestock management is recognized for its potential to influence habitat quality and sage-grouse populations across the region (Conservation Objectives Team and others, 2013); however, details of local conditions and grazing management were not summarized here. Fire risk is generally low across MZ I, with 17 percent of priority and general habitats having a high risk for fire (table 19); however, isolated areas, especially in central Montana, South Dakota, the border between Montana and Wyoming, and eastern Wyoming, are identified as having high fire risk (fig. 26). Risk of cheatgrass presence was not available for this region, but cheatgrass (and Japanese brome, *Bromus arvensis*) are known to occur across this region. Thus, risk of annual grass invasion, as well as annual-induced fire, appear to need better documentation across the region. To help prevent increasing cheatgrass dominance on these rangelands, potential for invasion can be assessed when planning habitat treatments and rehabilitating disturbed areas, with pre-disturbance abundance being a good indicator of potential for post-disturbance response (Davies and others, 2012). Urban development, power lines, vertical structures, and railroads directly influence less than 2 percent of the sage-grouse habitats in the region; however, this distribution is relatively dense compared to western portions of the range of sage-grouse (tables 5–9; figs. 10–13).

MZ II and VII—Wyoming Basin and the Colorado Plateau

Management Zones II and VII include nine sage-grouse populations with the bulk of the area constituting the Wyoming Basin population; several smaller areas occupied by sage-grouse are distributed around the Wyoming Basin population, especially south of this population on the Colorado Plateau (Garton and others, 2011). Northern portions of this MZ currently represent the highest abundance of sage-grouse relative to other MZs across the range of the species (Conservation Objectives Team and others, 2012); projections indicate that the chance of populations in this region falling below 200 males by 2037 is 0.3 percent and a 16 percent chance populations falling below 200 males by 2107 (Garton and others, 2011). Leks in northern portions of MZs II and VII are the most highly connected in the range (Knick and Hanser, 2011a). Conversely, populations in southern portions of MZs II and VII (Colorado Plateau) are not as robust with a projected 96 percent chance of populations declining below 200 males by 2037 and a 98 percent chance by 2107 (Garton and others, 2011). Additionally, leks in southern regions of the MZs are the least connected across the range of the species (Knick and Hanser, 2011). In contrast to MZ I, 54 percent of the sagebrush habitats in MZs II and VII are Federally managed (Knick and Connelly, 2011b). Therefore, conservation easements and farm bill programs that can only be applied to private lands will likely be ineffective as a sole means of conserving sage-grouse in these MZs; comparable programs affecting effective rehabilitation and restoration on public lands, at similar scales, are needed (Connelly and others, 2011b). The Wyoming Basin (MZ II) is currently home to the largest regional extent and highest breeding density of sage-grouse in the Western United States with several important satellite populations including Jackson Hole, Wyoming, and Routt County, Colorado. Livestock grazing has been ubiquitous across these sagebrush dominated ranges, which also have seasonal importance for native elk, mule deer, pronghorn, and several herds of feral horses, for more than a century. Nonrenewable energy extraction (coal, oil, and natural gas), and more recently renewable energy production (wind farms), are superimposed over the habitat gradients created by natural environmental patterns and historic land uses, and the current combination of use and natural dynamics are sufficiently intense to cause measureable changes in sagebrush cover (Xian and others, 2012). Therefore, trends in land cover and land use are recognized as contributing to population declines, in this region, in the recent past.

The major threat to sage-grouse habitats and populations occurring across populations in MZs II and VII is energy development—primarily oil and gas development—and supporting infrastructure (Conservation Objectives Team and others, 2012); less than 1 percent of priority and general habitats are directly influenced by natural gas or oil wells; however, more than 75 percent of PPH and more than 80 percent of PGH lie within the likely effects buffer (11.8 mi [19 km]) providing an indication of the widespread and cumulative influence of energy infrastructure (table 11, fig. 14). Further, approximately 7.8 million acres (31,500 km^2, 21 percent) of the sage-grouse habitats in these MZs are currently leased for development of Federal natural gas or oil reserves (table 13). This region also has Federal leases for the research of oil shale extraction overlapping the southern populations (fig. 19*A*). The potential for coal mining, geothermal energy development, oil shale development, and wind energy development are also widespread throughout this MZ (figs. 18–24). In spite of these competing factors, the loss of habitat from subdivision and housing development and associated infrastructure (for example, roads) has been identified as the greatest threat to sage-grouse populations in southern portions of MZs II and VII (Conservation Objectives Team, 2013). Urban development, power lines, vertical structures, and railroads directly influence less than 5 percent of the sage-grouse habitats in the entire MZ, and these infrastructures are relatively dense in MZs II and VII compared to western portions of the range of sage-grouse (tables 5–9, figs. 10–13). For example, the proportion of sage-grouse habitat influenced directly by urban development in MZs I, II, and VII combined is 3.1 times higher; the amount directly influenced by power lines is 2.1 times higher, and the amount directly influenced by railroads is 1.9 times higher than the proportion directly influenced in the other MZs combined (tables 5–9).

BLM managed grazing allotments not meeting wildlife standards consist of 4 percent of MZs II and VII and are not widespread throughout the region except in southern portions of the MZ (table 22, fig. 28); however, considerable portions of this region have not been recently assessed. Although areas not meeting standards are not widespread in the region, the Greater Sage-Grouse Comprehensive Conservation Strategy (Stiver and others, 2006a) ranked livestock grazing just below energy development and urbanization as an issue requiring immediate attention in eastern portions of the range of sage-grouse. Additionally, a large portion of central regions of this MZ (close to 5 million acres [20,200 km^2] across the entire MZ; table 23) is Federally managed wild horse and burro range (fig. 29), suggesting potential effects to sage-grouse of livestock grazing, and the compounding effects of feral grazers need to be considered across the region. Fire risk is generally low across MZ II and VII with 10 percent of priority and general habitats at high risk for fire (table 19); however, areas in northern and southern portions of the MZ are identified as having high fire risk (fig. 26).

Cheatgrass is distributed across the region, however, generally not with the same abundance observed in the Great Basin region; some portions of this region, for example, the ownership "checkerboard" in southern Wyoming, are notably more thoroughly invaded than cooler parts of the region. Where severe infestation overlaps with PPH and PGH, management-intensive restoration may be considered. Current levels of disturbance have been sufficient to spread invasive species, and the historic combination of drought-stress and overutilization left sufficient niche space among native perennials for local proliferation. In many areas, short-term adaptations of grazing rotations to increase the cover of native perennials may be sufficient to restore high-quality habitats. Despite the perceived abundance and persistence of sagebrush in some parts of this region, extensive (or cumulative) treatments that remove sagebrush cover (even temporarily) are discouraged, unless said treatments represent a very small portion of an extensive, intact sagebrush stand (very rare) or are expressly designed to rehabilitate degraded, underutilized habitats.

MZ III—Southern Great Basin and Western Colorado Plateau

Management Zone III consists of 12 sage-grouse populations distributed throughout the region including the Southern Great Basin population in central and eastern Nevada, which contains the largest numbers of sage-grouse in MZ III (Conservation Objectives Team and others, 2013), several small populations in central Utah, and the Bi-State Distinct Population Segment along the California-Nevada border (Garton and others, 2011). Predicted population trends indicate that populations in this MZ have almost no chance of falling below 200 males by 2037 and an 8 percent chance of falling below 200 males by 2107 (Garton and others, 2011); however, these scenarios are limited in their ability to predict the future, especially stochastic events and novel environmental conditions, so caution is warranted. A majority (82 percent) of the sagebrush landscape in this MZ is Federally managed (predominantly BLM and USFS; table 26), indicating that actions on Federal lands are expected to have measurable population effects, and conservation measures on private lands may be less influential, as a whole, for conserving sage-grouse in this MZ. However as noted in sections above, large areas of influence exist from some threats; therefore, cooperation and prioritization of habitats across jurisdictions is still important in this Management Zone. This region is best characterized (for sage-grouse) by the large Southern Great Basin population, which occupies much of central and eastern Nevada; however, several smaller but significant populations persist, and priority management issues and challenges associated with these small populations may be distinctive from other populations in the region.

Sagebrush cover is naturally limited and patchy across much of this region, as dictated by geologic substrates and formations that also help dictate (via topography) microclimates and local environmental conditions that enable sagebrush dominance, and this is evident in the lack of connectivity among subpopulations in this region (Knick and Hanser, 2011). Well densities are currently low compared to other MZs (for example, MZs I and II). Current energy developments influence sage-grouse habitats in eastern portions of the MZ but are not widespread (figs. 14 and 16); however, more than 1.8 million acres (7,285 km^2; 13 percent) of the sage-grouse habitats in the MZ are currently leased for Federal fluid-mineral development (table 13) suggesting that some areas may receive increased pressure from energy development in the future. Additionally, coal and oil shale potential are high in eastern areas (Utah) of MZ III (figs. 19 and 23) indicating that development of these resources could affect already isolated populations in Utah. High potential for geothermal energy development coincides with sage-grouse habitats in central and western portions of MZ III (fig. 21*B*), and solar-energy potential is high in southern portions of the region indicating that these alternate energy sources could have impacts on sage-grouse habitats in southern Nevada and Utah in the future (depending on technology, financial markets, and public policies).

In contrast, the number and size of areas affected annually by fire in this MZ are an order of magnitude greater than is typical in the Wyoming Basin (MZ II) to the east, suggesting that land-use disturbance has been replaced, or substituted, with frequent fire in these areas; this condition is often closely tied to the invasion and dominance of annual grasses, especially cheatgrass, due to their effect on fuels and fire-return intervals (figs. 25 and 26). Since 2000, 404,000 acres (1,635 km^2; 2.8 percent) of priority and general sage-grouse habitats (PPH and PGH combined) have burned in this MZ. Annual means suggest that only 13,500 acres (54 km^2; <2 percent) of habitats (PPH and PGH) burn each season; however, the observed maximum is more than 55,000 acres (220 km^2; 0.5 percent of PPH and 1.4 percent of PGH in this region). Importantly, 63 percent of the region is considered at high risk for fire (tables 19, fig. 26). Conifer encroachment potentially affects more than 1.8 million acres (7,285 km^2; 13 percent) of priority and general habitats in MZ III (table 21). Precise estimates of actual impact are not available; therefore, evaluation of local habitat priorities and potential treatment benefits to inform planning efforts may require higher resolution data. Cheatgrass invasion has been widespread in this region for decades, and some former (historic) habitats are likely “unrecoverable” without unreasonable infusion of restoration effort (that is, it would be too expensive given current knowledge and technology); many of these areas are already excluded from current habitat distributions (fig. 1). Nonetheless, current estimates indicate more than 30 percent of PPH and 40 percent of PGH remain at high risk of invasion with notable risks remaining in some areas. Beyond managing risk, restoration of potentially valuable areas, such as those that would increase connectivity among seasonal habitats or subpopulations, or simply increase area and quality of current seasonal ranges, may become an important management option where natural and anthropogenic patterns and processes have fragmented and degraded habitats.

In addition to cheatgrass, widespread, intense land use coupled with natural variability and limitations of climate has resulted in measurable effects on rangeland conditions. Currently (2006), 1.6 million acres (6,475 km^2) of the BLM managed sage-grouse habitats in MZ III (17 percent) do not meet wildlife standards due to grazing impacts (table 22). Further, more than 4.1 million acres (16,590 km^2; 29 percent) of this area is designated wild horse and burro range; most of these areas are in central Nevada (table 23, fig. 29*A*). Horse and burro herbivory has been connected to intense resource use and measureable effects on range conditions and habitat quality (Beever and Aldridge, 2011).

Urbanized areas, power lines, and railroads influence habitats in eastern portions (Utah) of this MZ but are not widespread in central and western portions. Agricultural development influences less than 1 percent of the MZ, however due to indirect influences, 78 percent (the lowest proportion across MZs) of priority and general habitats are estimated to be affected by cropland (table 4, fig. 9).

MZ IV—Snake River Plain

Management Zone IV consists of 11 sage-grouse populations distributed throughout the region with the bulk of the occupied area consisting of the Northern Great Basin and Snake-Salmon-Beaverhead, Idaho populations (Garton and others, 2011). Similarly to other regions, the Snake River Plain of southern Idaho has a long history of agricultural land uses that include irrigated crops and open-range livestock management. Historic conversion of the best sites (deepest soils) to agriculture (a practice that was widespread with nearly complete conversion in this region) has resulted in a residual sagebrush landscape that is inherently less productive than those of the past (prior to European colonization). Subsequently, most known populations in the region are relatively small and (or) separated from adjacent populations; important exceptions are the large population living in central Idaho (the largest outside of the Wyoming Basin) within the upper watershed of the Snake, Salmon, and Beaverhead Rivers, and the Northern Great Basin population living on the Snake River Plain (Conservation Objectives Team, 2013). Several small, isolated populations are located in predominantly northern portions of this MZ (Garton and others, 2011). Nonetheless, habitat availability remains a primary limiting factor in this region due to the combination of land-use and disturbance (fire) influences, and influences of current and historic land uses add to these effects through effects on the health and condition of available ranges.

Population trends and vulnerability models indicate that populations in this MZ have an 11 percent chance of falling below 200 males by 2037, and a 40-percent chance of falling below 200 males by 2107 (Garton and others, 2011). A majority (63 percent) of the sagebrush landscape in this MZ is Federally managed (Knick 2011), suggesting conservation measures on public lands may be expected to have measurable effects on sage-grouse populations, and the role of private lands will remain important but limited, in general, as a means of conserving sage-grouse in this MZ. Local importance and effectiveness of projects may be greater than rangewide effects due to local contributions to seasonal habitat quality and connectivity.

Primary threats to sage-grouse habitats and populations occurring across populations in MZ IV include habitat loss and fragmentation as a result of wildfire (Conservation Objectives Team, 2013). Since 2000, more than 4.9 million acres (21,000 km^2; 14 percent of PPH and 17 percent of PGH) of priority and general sage-grouse habitats have burned in this MZ, with an average of more than 239,000 acres (970 km^2) of priority habitats burned annually; more than 1 million acres (4,047 km^2) burned in some years (table 18, fig. 25). For example, the Murphy Fire in Idaho and Nevada affected more than 650,000 acres (2,630 km^2) of habitat in this MZ in 2007 (Conservation Objectives Team, 2013). Additionally, 81 percent of the region is considered at high risk for fire (table 19, fig. 26). Approximately 11.6 million acres (47,175 km^2; 53 percent) of PPH and 6.4 million acres (25,900 km^2, 58 percent) of PGH in MZ IV are considered high risk for cheatgrass, and these high-risk areas are widespread throughout the MZ (table 20, fig. 27*A*).

Geothermal energy development potential is particularly high throughout MZ IV (fig. 21*B*). Very few active oil and gas wells exist in the MZ (fig. 14), although there has been some exploration historically, and less than 350,000 acres (1,400 km^2; 1 percent) of sage-grouse habitats are currently leased for Federal fluid-mineral exploration (table 13). Additionally, coal and solar potential are low throughout the MZ (figs. 20 and 22). Urbanized areas, power lines, and railroads influence habitats predominantly in eastern portions (eastern Idaho and southwestern Montana) of MZ IV (tables 5–9, figs. 10–13). However, designated energy corridors are located in southern portions of the MZ, and transmission lines are proposed in these areas, for example Gateway West (see *http://www.wy.blm.gov/nepa/cfodocs/gateway_west/map.html*). Agricultural development influences 1 percent of the MZ, and 85 percent of priority and general habitats are within 4.3 mi (6.9 km) of cropland (table 4, fig. 9).

Finally, historic and current land-use patterns affect habitat conditions, in addition to regional distributions. Currently (2006 assessment) more than 3.5 million acres (14,160 km^2) of BLM managed sage-grouse habitats (19 percent) do not meet wildlife standards due to livestock (table 22, fig. 28) in this MZ; this is the largest area, absolutely and proportionally, of all MZs (albeit large portions of some other MZs were not assessed). Compounding the effects of large herbivores on ecosystem conditions, some habitat within this MZ (6 percent) is Federally managed wild horse and burro range including a relatively large area of priority habitat in northern Nevada (table 23, fig. 29*A*). Though managed grazing remains a part of the tools used to manage habitats into the future, with a potential role for addressing fuel accumulation and fire potential, invasive plants, and vegetation structure and composition, non-prescribed grazing (over-grazing), as determined by local conditions and climate patterns, is clearly implicated for its detrimental effects on rangeland health as well as habitat conditions, in some areas. Thus in this MZ, and other areas, where the interactions of ecosystem conditions, climate, and multiple herbivores may result in habitat degradation, close monitoring of productivity and off-take to manipulate and adjust use levels to maintain seasonal habitat quality may be necessary. Importantly, local conditions and environmental patterns (such as climate) are highly variable, and direct assessments are dated (>5 years old in most cases); therefore, trends and conditions assessed here may have changed. This reinforces the need for frequent evaluation and adjustments to balance multiple uses with habitat requirements of the native wildlife.

MZ V—Northern Great Basin

This MZ includes three large populations living on the western one-third of the Northern Great Basin region and a fourth, relatively large population in central Oregon (Garton and others, 2011). Predicted population trends indicate that populations in this MZ have a low (2 percent) chance of falling below 200 males by 2037 and a greater (29 percent) chance of falling below 200 males by 2107 (Garton and others, 2011). A majority of the sagebrush landscape in this MZ (77 percent) is Federally managed (Knick and Connelly, 2011b), suggesting conservation measures that can only be applied to private lands may be insufficient for conserving sage-grouse in this region, but Federal habitat management may be expected to have a strong influence on these populations. Sage-grouse leks in this region are relatively well connected (second in rank behind Wyoming Basin; Knick and Hanser, 2011b); however, a national team of experts identified habitat loss and fragmentation due to wildfire and conifer encroachment as primary threats to sage-grouse in this region (Conservation Objectives Team, 2013).

The Northern Great Basin region contains less “moderately” and “highly’ affected sage-grouse habitat than the west-wide average. But it also contains the most extensive “low” land-use intensity distribution of all MZs indicating priorities focused on managing low-intensity, distributed land uses to conserve and improve habitat for grouse (passive approaches should be effective and efficient) may be critical to regional conservation success. Similarly, areas with intensive use that overlap priority habitats (PPH and PGH) may be readily prioritized for habitat improvements because these areas are less extensive than in adjacent regions. However, since 2000 more than 1.5 million acres (6,400 km^2; 12.2 percent) of priority (17.5 percent) and general (5.8 percent) sage-grouse habitats burned with an average size of more than 95,000 acres (385 km^2) per year during this time span (table 18, fig. 25). Additionally, 67 percent of the region is considered at high risk for fire (table 19, fig. 26). Despite these fires, conifers have encroached on approximately 1.4 million acres (5,670 km^2; 11 percent) of priority and general habitats in MZ V (table 21) indicating, again, that the spatial heterogeneity in habitat threats and conditions require local interpretation and adaptation to differentiate threats and develop specific management solutions. As another example, low sagebrush (*A. arbuscula*) is common only in the Northern Great Basin, although it occurs throughout the range at varying abundance (Johnson and others, 2011), and it is utilized by sage-grouse consistently here, in multiple seasons, including nesting and brood-rearing, making proper management and conservation of this ecological type important for sage-grouse conservation in this region.

More than 5.6 million acres (22,735 km^2; 43.5 percent) of MZ V are considered moderate to high risk for cheatgrass; a large block of high-risk priority habitat is located in northwestern Nevada (table 20, fig. 27*A*). More than 3.6 million acres (14,570 km^2; 28 percent) of sage-grouse habitats distributed throughout MZ V is Federally managed wild horse and burro range (table 23, fig. 29*A*). Approximately 6 percent of BLM managed sage-grouse habitats in MZ V do not meet wildlife standards (table 22, fig. 28), with again a relatively large block of priority habitat not meeting standards in northwestern Nevada.

Finally, though no single threat supersedes others, there are various forms of industrial development that affect habitats in this region. No active oil and gas wells currently exist in the MZ (fig. 15), and no measurable additional acreage has been leased for fluid-mineral exploration (table 13). However, geothermal energy potential is high throughout the region indicating potential for future development (fig. 21). Urbanized areas, power lines, and railroads are less dense in MZ V than in eastern portions of the sage-grouse range (tables 5–9, figs.10–13*A*). However, the Warm Springs Valley population, a small area on the California-Nevada border (Garton and others, 2011), is known to be influenced by urbanization and a transmission line (Conservation Objectives Team, 2013). Agricultural developments currently influence less than 1 percent of the MZ; however, 75 percent of priority and general habitats are within the influence of cropland (table 4, fig. 9) indicating a high likelihood of influence, without direct displacement.

MZ VI—Columbia Basin

The sage-grouse habitats within the Columbia Basin are among the most developed (primarily agriculture) and heavily used landscapes still occupied by sage-grouse. These two, small populations are also affected by living near the distribution limits of the species and suitable sagebrush habitats. Washington populations do not significantly occupy BLM lands, so while important to the overall conservation of the species, this region is not directly addressed in this assessment. CRP lands can create habitat refugia within converted landscapes when they include sagebrush cover; enrollment of 17 percent of an agricultural landscape in eastern Washington succeeded in reversing short-term population declines, whereas declines continued on adjacent landscape with fewer CRP-designated lands (Schroeder and Vander Haegen, 2011). These populations are recognized here but are part of an independent plan and assessment process.

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Appendix. Data Sources and Analysis for the Greater Sage-Grouse Threat Assessment

Introduction

The primary purpose of the geospatial analysis is to quantitatively assess the location, magnitude, and extent of the primary threats to Greater Sage-Grouse (hereafter, sage-grouse) habitats and populations. Understanding these factors and being able to compare differences between areas across the range of the species provides overarching biological information that informs planning. For landscape species (defined in this context as a species where populations occupy large ranges that cross traditional management boundaries), the evaluation of current and future status (such as the impact associated with alternatives in the context of the National Environmental Protection Act (NEPA) planning and review process) must take into account biologically meaningful scales, which may be larger than the planning area being assessed. This allows specific areas to be put into the larger context so that decision makers can understand more site-specific conditions, place finer resolution data into context, and make allocation and other land-use planning decisions. The tradeoffs and prioritization inherent in applying a conservation strategy first require understanding the nature and extent of threats across the range of a species and then looking at smaller scale areas in context to allocate resources to reduce threats in these areas that are meaningful for the species.

Therefore, we strove to collect geospatial data representing the threats to sage-grouse as identified by scientific research and outlined in the 2010 USFWS listing decision. We measured the direct impact to sage-grouse habitats, as well as the indirect impacts to habitats and populations through applying buffer distances representing impacts to the species as identified in the literature. These potential measures of impact were then compared to current BLM preliminary priority habitat and preliminary general habitat delineations (see Section 1) to understand the condition and threats across the highest densities of sage-grouse and sagebrush habitats as well as the rest of the currently occupied range. In addition, we examined surface-management entities in relation to each threat so that multiple landowners and managers across the range of the sage-grouse can understand impacts under their jurisdiction as well as neighboring jurisdictions. This landscape approach allows for population-level assessments despite checkerboards of surface-management entities. Overall this effort is intended to provide information to conservation planning teams to understand the issues, determine appropriate alternatives, and ultimately provide biologically meaningful analyses of sage-grouse populations (for example, information on the past and current conditions for cumulative impact analyses in the WAFWA Management Zones for sage-grouse).

Methodology

Identification of Threats

Threats for the sage-grouse are identified in the 2010 USFWS listing decision for five factors. These common threats and issues fall into categories that were recognized by USFWS in the published findings—habitat change (Factor A), over-utilization (Factor B), disease and predation (Factor C), policy and land use (Factor D), and chemical poisoning (Factor E). Primarily threats that can be represented spatially with current data are found in Factor A. Factors B through D are typically described qualitatively, although for this report, Factor D information was collected for management classifications with the purpose of identifying areas where habitats are protected from development. For each threat we collected information in up to four categories (if data were available):

1. Land Allocation and Management—management focus (conservation versus multiple use) and data associated with reduction and or limitation of threat categories (table A-1)
2. Current Threats—physical footprints and locations of anthropogenic features and natural processes that impact sage-grouse habitats (tables A-2, and A-3)
3. Valid Existing Rights—management decisions and projects approved but where features may not currently exist (includes leasing and allocation decisions from land management agencies where data could be collected in the project time frames) (tables A-2 and A-3)
4. Potential Threats—data on the potential of anthropogenic features and natural processes; in many cases these are associated where land uses may occur but do not take into account distribution, infrastructure, or other factors necessary for actual projects to be located in these areas (tables A-2 and A-3)

Determination of Direct and Indirect Distances

Direct impact of any particular threat was measured as acres of physical ground disturbance or linear miles of the feature. In many cases polygon data were available that represented the physical footprint of a feature, but in some cases, we buffered point features with appropriate distances to represent the typical footprint of development (see tables A-1 and A-4). These distances were derived from programmatic Environmental Impact Statement (EIS) documents, industry standards, or expert opinion (see tables A-1 and A-4).

Section 3 of this report identifies multiple literature sources that reported effects associated with the threats identified in the USFWS listing decision. We selected the indirect impact distances as appropriate for each threat, based on peer-reviewed scientific literature that represented impacts typical of sage-grouse populations across the range. These distances may not represent impact for all populations, but many come from rangewide or cross-population analyses where a statistical impact at the buffered distance was identified. They are used in the report to identify issues that should be looked at more closely during the creation of land management and conservation plans for sage-grouse (tables A-1 and A-4). We chose to use distances where an impact could be determined, not necessarily a more specific look at avoidance behaviors associated with a feature. Therefore, it is important to note that impacts across an indirect buffer distance are likely not uniform; typically there is a decay function that more fully represents the relation. In setting metrics or thresholds for site-specific applications and analyses, the additional scientific summaries in this document along with local knowledge on home-range size, migratory patterns, habitat availability, and other factors, are important when interpreting the effects on sage-grouse habitat and populations and addressing specific questions or objectives associated with impacts to sage-grouse habitats and populations.

Collection of Geospatial Data

All data analysis was conducted by the BLM's National Operations Center in Lakewood, Colo. Data was collected and assembled from National BLM sources, individual BLM States, USFS national sources, and external sources depending on the authoritative source for types of features (tables A-2 and A-3). In some cases data from multiple sources was aggregated to best represent the feature or phenomenon. In addition, some data was only available for Federal lands or for only a part of the study area.

Geospatial data were acquired for all threats identified in the USFWS listing decision that can be represented spatially. These data were acquired rangewide, as available, from both internal (BLM and USFS) and external sources beginning in August 2011 (tables A-2 and A-3). All data, both internal and external, were considered the "best available" at the time of data collection. National data were "frozen" in June and July of 2012, with updates made to some datasets as late as December 2012. Other data (for example, compiled from other sources) were the most current available, based on the supplying office, agency, or organization (see tables A-2 and A-3). Internal data were compiled using intra-agency data calls and often included data submitted in segments, from different administrative units, across the BLM and USFS management areas (see fig. A-1 for the full process). These datasets were aggregated and reviewed, but time constraints limited the ability to revise these data for quality and completeness, fix geometry errors (gaps and overlaps), and edge-match across jurisdictions (fig. A-1). The metadata associated with each dataset details the analysis and methodology procedures and provides details relating to specific data.

After data collection was complete, input datasets were preprocessed. Preprocessing steps included reclassification, attributing, buffering, and other formatting tasks. Categorizing datasets into relevant attributes and supplementing them with additional attributes was necessary for data compatibility. Collaboratively developed priority habitat designations (PPH and PGH) were combined with surface management agency (SMA) and WAFWA management-zone polygons into one master summary file (MSF) with a unique identification (ID) reflecting the specific combination of habitat (PPH or PGH), management entity, and WAFWA MZ for each polygon to provide for efficient, repeatable, and consistent data analysis. All datasets were clipped to the rangewide study area, and small and superfluous polygons were dissolved, to reduce the number of features and remove unnecessary attributes. Finally, data were sorted into point, line, and polygon features for different analyses that reflected the represented footprint and modeled effects (see table A-1).

Overlay comparisons were generated using ArcGIS Model Builder (version 10.0) with separate models created for point, line, and polygon input data (see fig. A-1). In brief, these models intersect the input data with the master summary file (MSF), which includes representation of the spatial summary units (MZs), and dissolve the resulting intersect file to single polygons based on the unique ID assigned in the intersection. Finally, statistics were calculated for each threat overlay using the number of points, linear miles, or area within the specific combination of habitat type, management entity, and MZ. The resulting data were then exported from the GIS to Microsoft Excel for summary calculations (fig. A-1). For each of the categories/types of data, the pre-processing steps were as follows:

Base Layers

Preliminary Priority Habitat/Preliminary General Habitat

This dataset is the consolidated submissions of State-submitted Greater Sage-Grouse Preliminary Priority and Preliminary General Habitats (table A-2). These data are a snapshot of State defined PPH/PGH polygons as of June 26th, 2012 – priority habitats may also be described as "core areas" in some contexts. States may have continued to refine the PPH/PGH designations beyond this date. Specifics on each State's submission follow:

- California—PPH and PGH: FINAL DRAFT; Developed cooperatively by California BLM and California Department of Fish and Game.
- Colorado—PPH and PGH: FINAL DRAFT; Developed by Colorado Parks and Wildlife in cooperation with Colorado BLM.
- Idaho—PPH and PGH: Version 2 (April 2012); Developed by the Idaho BLM State Office with input from Idaho BLM Field Offices, the U.S. Forest Service, and Idaho Department of Fish and Game. Version 2 reflects refinements and additional data that were incorporated into Version 1 following further analysis and public

scoping for the BLM Sage-Grouse Conservation Planning effort.

- Montana—PPH and PGH: FINAL DRAFT; Developed by Montana Fish, Wildlife and Parks and reviewed by Montana BLM

- Nevada—PPH and PGH: SEMIFINAL DRAFT; Developed by Nevada Department of Wildlife in cooperation with Nevada BLM (90 percent completed).

- North Dakota—PPH: FINAL DRAFT; Developed by North Dakota Game and Fish Department in cooperation with Montana/Dakotas BLM; PGH: FINAL DRAFT; Distribution of Sage-Grouse in North America (Schroeder and others, 2004).

- Oregon—PPH and PGH: FINAL DRAFT; Developed by Oregon Department of Fish and Wildlife in cooperation with Oregon BLM.

- South Dakota—PPH and PGH: FINAL DRAFT; Acquired from Montana/Dakotas BLM.

- Utah—PPH: SEMIFINAL DRAFT; Developed by Utah Division of Wildlife Resources; under review by Utah Governor's Office; Utah BLM will use Division of Wildlife Resources (DWR) Occupied Habitat (9/2011) in the interim; PGH: All DWR Occupied Habitat is considered Priority, so PGH does not apply.

- Wyoming—PPH and PGH: PPH (June 2010): Core Management Areas-Version 3; Developed by the Wyoming Governor's Sage-Grouse Implementation Team and Wyoming Game and Fish Department in cooperation with Wyoming BLM (PGH modified from Distribution of Sage-Grouse in North America; Schroeder and others, 2004).

WAFWA Management Zones

This dataset depicts the Management Zone boundaries as defined by the Western Association of Fish and Wildlife Agencies for Greater and Gunnison Sage-Grouses in the Western United States and Canada. It was not altered in any way for this effort. MZ II and VII were combined for summary analyses.

Federal Agency Management (Surface Management)

This dataset provides management data for all Federal agencies, as well as State, local, and private lands. It was updated with U.S. Forest Service authoritative data provided in May 2012. Because of inconsistencies in the manner in which BLM States define and categorize SMA designations, and in order to focus analysis on BLM and USFS management at the landscape scale, the following Federal agencies and tribal entities were classified into one category called "Tribal and Other Federal": BIA, BOR, BPA, COE, DOD, DOE, Federal Aviation Administration (FAA), FWS, GSA, NPS, tribal and non-forest USDA. Other minor land management entities, topology errors, unknown areas, and unclassified areas were combined into an "other" category during final summary of the data. In addition, areas classified as water were removed to restrict the summary tables to terrestrial habitats.

Land Allocation and Management

Federal Fluid Minerals—Areas Closed to Oil and Gas Leasing

This polygon dataset is the consolidated submissions for locations closed to oil and gas development data from BLM States. Areas overlapping with submitted oil and gas leases and leases held-by-production polygons were removed.

Conservation Focused and Protected Areas

The National Conservation Easement polygon database was subset to include only those features where "Duration" = "Permanent."

USGS Protected Areas Database (PAD-US, v. 1.2) polygons with level of protection (GAP Status) codes 1 and 2 (see below) or unknown were subset to provide National Park Service and State and private lands polygon datasets. Additionally, Wilderness and USFWS Refuges datasets were supplemented with additional refuge or wilderness features found in PAD-US. Finally, ACEC (Areas of Critical Environmental Concern) and NLCS (National Landscape Conservation System) polygons were categorized by GAP Status code using PAD-US, and only those with codes 1, 2, or unknown were retained.

GAP Status codes 1 and 2 are defined as follows:

1. An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

2. An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

National Landscape Conservation System (NLCS) and Areas of Critical Environmental Concern (ACEC) polygons provided by the BLM data steward were subset to include only those with PAD-US GAP Status categories 1, 2, or unknown. Input NLCS units included National Conservation Areas, Wilderness Study Areas, National Monuments, Cooperative Management and Protection Areas, and Outstanding Natural Areas.

Wilderness polygons were derived from all wilderness-land polygons from the BLM and USFS Wilderness databases, supplemented with NPS and FWS Wilderness from PAD-US.

USFWS Refuges polygons from the National Wildlife Refuge Boundary and Parcel Data database were supplemented with additional data from the PAD-US database where "Primary Designation Type" = "National Wildlife Refuge" and GAP Status category was 1, 2, or unknown.

National Park Service polygons were determined by pulling a subset of PAD-US where "Own_Name" = "0145" (NPS) and GAP Status was 1, 2, or unknown.

State and Private land polygons with GAP Status categories of 1, 2, or unknown were pulled from PAD-US by selecting "Own_Type" = "03"' OR "Own_Type" = "04" OR "Own_Type" = "05" (State, regional and local) or "Own_Type" = "07" (private).

Because there was overlap of polygons in the above datasets, they were merged and dissolved before conservation area on PPH and PGH statistics were calculated.

Current Threats

Agricultural Development

This polygon dataset is a subset of the USDA National Agricultural Statistics Service's (NASS) Cropland Data Layer (CDL). For the purpose of creating a crop-specific layer, the following features were excluded from this dataset: Barren, Deciduous Forest, Developed/High Intensity, Developed/Low Intensity, Developed/Med Intensity, Developed/Open Space, Evergreen Forest, Grassland Herbaceous, Herbaceous Wetlands, Mixed Forest, Open Water, Other Hay/Non Alfalfa, Pasture/Hay, Pasture/Grass, Perennial Ice/Snow, Shrubland, and Woody Wetlands. Raster data were converted to polygon vector data and were buffered to create indirect influence areas.

Urbanized Areas

This polygon dataset is a subset of the City Limits dataset from Tele Atlas ESRI Street Map Premium for ArcGIS v 9.0. City limit polygons falling on Bureau of Indian Affairs land, which were also found to be of limited development using aerial imagery inspection, were manually removed from this dataset. Features were buffered to create indirect influence areas.

Major Power Lines and Associated Infrastructure

This polygon dataset is a compiled layer of two power line datasets, which together provide the most complete spatial representation of this threat across the study area. Linear features from power lines in the Western United States, ICBEMP existing utility corridors dataset, 2004, and transmission lines, substations, electric power generation plants, and energy distribution control facilities from the EV Energy Map, Platts/Global Energy, 2005, were merged to create a combined layer. Features (lines and points) were then buffered to create direct and indirect influence areas. We did not calculate linear distances because minor spatial errors between the dataset resulted in sections of power lines being duplicated. Buffering and dissolving features off of these linear features represented direct impacts of development as an acre footprint and removed issues of double counting from a linear mile measurement.

Communication Towers and Other Vertical Structures

This dataset is compiled from the FAA Digital Obstacles point file and the Federal Communications Commission (FCC) communication towers point file. Points with "Type_" = "WINDMILL" were removed from the FAA file and were processed in a separate analysis. Additionally, all duplicate points were removed. Finally, features were buffered to create direct and indirect influence areas.

Fences

This dataset is a merged layer of allotment and pasture-data files submitted by the USFS and the BLM. This aggregate dataset identifies pasture and allotment borders, represented as linear features, for allotments within BLM and USFS managed public lands. This acts as a surrogate for fences for those areas with BLM or USFS management (in many cases only a portion of a pasture or allotment) and therefore does not represent fence density for areas with solely other Federal or non-Federal management.

Interstate, Highway, and Secondary Roads

This dataset is a subset of the ESRI Tele Atlas ESRI StreetMap Premium for ArcGIS v 9.0 2008, Dynamap Transportation version 5.2, 2003, Detailed Streets dataset. The following queries were used to select interstates, highways (primary and secondary), and secondary (other) road types: Interstates, "FCC" IN ('A10', 'A11', 'A12', 'A15', 'A16', 'A17', 'A18'); Highways, "FCC" IN ('A20', 'A21', 'A22', 'A23', 'A24', 'A25', 'A26', 'A27', 'A28', 'A30', 'A31', 'A32', 'A33', 'A34', 'A35', 'A36', 'A37', 'A38'); and Other roads, "FCC" IN ('A40', 'A41', 'A42', 'A43', 'A44', 'A45', 'A46', 'A47', 'A48', 'A50', 'A51', 'A52', 'A60', 'A64', 'A70'). Linear features were then buffered to create direct and indirect influence areas. The three-road-type buffer files were combined for each influence distance with overlap areas removed for analysis.

Major Railroads

This dataset includes abandoned and non-abandoned railroads from the Federal Railroad Administration (FRA) Rail Lines of the U.S.A. dataset. Abandoned and non-abandoned rail lines were separated into two linear files using the attribute indicating the status of the rail line. Non-abandoned linear features were buffered to create direct and indirect influence areas, whereas abandoned features were buffered to create only direct influence areas.

Large Wildfires

This dataset includes polygon data representing the perimeters of wildfires submitted to the Geospatial Multi-Agency Coordination (GeoMAC) Group occurring during the period 2000 through 2012. Polygon areas were used to represent direct influence.

Moderate to High Probability of Cheatgrass Occurrence

This is a modeled dataset created to depict the probability of cheatgrass occurrence in several floristic regions (Meinke and others, 2009). Inputs for regression analysis included elevation, precipitation, soil pH, soil depth, soil salinity, and available water capacity extracted at 6,736 field sampling locations where cheatgrass occurrence was determined. The data were subset using the 5–10 percentile range to reflect a "moderate to high" risk of cheatgrass occurrence as in Meinke and others (2009). Raster data were converted to polygon vector data. Polygon areas were used to represent direct influence.

Pinyon-Juniper and Other Conifer Encroachment Risk

This is a derived dataset using the methodology from the BLM Rapid Ecological Assessment of the Northern Basin and Range and Snake River Plain (DOI, 2010). To create this layer, GIS focal statistics were used to identify areas of adjacency between sagebrush and pinyon/juniper, and sagebrush and any other cells classified as conifer, as classified in the National GAP landcover GIS database. These cells were then buffered 120 meters into sagebrush to represent potential expansion into sagebrush areas. Raster data were converted to polygon vector data for analysis. Polygon areas were used to represent direct influence.

Grazing

This dataset consists of BLM grazing allotments and pastures polygon supplemented with the 2008 BLM Land Health database (Veblen and others, 2011; Assal and others, 2012). Allotments were selected from the database that were not meeting land-health standards for wildlife with grazing as the causal factor in the non-achievement, as well as those allotments where an assessment had not been completed. These allotments were then joined to the BLM Geospatial Science Support Program (GSSP), National Allotment GIS dataset on June, 28 2012, using the unique State allotment ID. Of the 1,135 allotment records from the spreadsheet, 21 were not able to be mapped. Polygon areas were used to represent direct influence.

Wild Horse and Burro Herd Management Areas (HMAs)

This polygon dataset is a compilation of BLM wild horse and burro and USFS wild horse and burro HMA polygons. Polygon areas were used to represent direct influence.

Oil and Gas Development Related Wells

This dataset is a compilation of two oil and gas well databases: the proprietary IHS Corporation Enerdeq database and the BLM Automated Fluid Minerals Support System (AFMSS) database. Wells producing within the last ten years from IHS and Active wells from AFMSS, as well as plugged and abandoned within the last 10 years from both datasets, were buffered by 62 m to provide direct effects. Producing wells from IHS and Active wells from AFMSS were buffered by 3 km and 19 km to provide indirect effects. We chose the ten-year criterion for inclusion of wells as our analysis of time-lag effects suggested that there is a delay of 2–10 years between activity associated with energy development and its measurable effects on lek attendance; therefore, flagging past development allows identification of areas where issues from production and development from fields may remain. The IHS dataset includes the following states: Calif., Colo., Idaho, Mont., N. Dak., Nev., Oreg., S. Dak., Utah, and Wyo. downloaded in December 2012. It was subset to exclude points occurring also in the BLM AFMSS database. AFMSS data are current as of December 19, 2012, for the following BLM States: Calif., Colo., Idaho, Mont., N. Dak., Nev., Oreg., S. Dak., Utah, and Wyo. Points from both datasets were aggregated by square mile to create the well density figure.

Federal Managed Coal, Surface Mining Development

This polygon dataset is the consolidated submissions for Federal coal lease data. Leases were defined as surface coal leases and subset from the original dataset based on guidance from BLM planners and mineral specialists. Polygon features were used for direct footprint and buffered for indirect influence areas.

Mining and Minerals Materials Disposal (Federal Minerals Only)

This polygon dataset is a compilation of two datasets consolidated from submissions from BLM States. The two datasets include mineral materials disposal sites and locatable mining claims. Both datasets were submitted as polygon data. Polygon areas were used to represent direct influence and were buffered to create indirect influence areas.

Wind Turbines

This dataset is compiled from the Federal Aviation Administration Digital Obstacles point file to include points where "Type_" = "WINDMILL". Aerial imagery was used to verify that these points represent wind turbines. All duplicate points were removed and features were buffered to create direct and indirect influence areas.

Valid Existing Rights

Federal Geothermal Leasing

This polygon dataset is the consolidated submissions for geothermal lease and approved project data from BLM State offices. Lease boundaries defined polygons that represented direct influence areas with existing rights.

Federally Managed Fluid Minerals—Leased Areas and Status

These datasets (leased areas and leases held by production) are a compilation of polygon datasets consolidated from submissions from BLM States. The two datasets include (1) oil and gas leases (limited to "Authorized": Case-types beginning with 310, 311, or 312 and not held by production, as needed) and (2) oil and gas leases held by production (limited to "Authorized": Case-types beginning with 310, 311, or 312, and HbP codes of 650, 651 or other attribute field populated to indicate held by production).

Oil Shale Leases

This polygon dataset is the consolidated submissions for oil shale research, development, and demonstration lease data from BLM States.

BLM Wind Energy Rights of Way (ROW)

This polygon dataset is the consolidated submissions for wind energy rights of way and approved authorizations data from BLM States.

Potential Threats

Large Fire—High Burn Probability

A derived dataset based on a national burn probability (BP) raster dataset for the United States was generated for the 2012 Fire Program Analysis (FPA) System. These data were provided by the National Interagency Fire Center (NIFC). The source raster was subset to the rangewide analysis area and reclassified to nominal classifications creating two categories of data, plus a zero category: Non-burnable = 0, Low probability = 0.00002–0.0043, and High Probability = 0.0043–0.0732. The high-probability dataset was subset as a raster file and then converted to vector format for analysis.

Coal Potential

This dataset includes polygons from the America's Coal Potential database compiled and published by the USGS (Tewalt and others, 2008).

Oil and Gas Potential

This is the raster dataset for relative oil and gas potential as described in Copeland and others (2009) "Mapping Oil and Gas Development Potential in the US Intermountain West and Estimating Impacts to Species." This continuous dataset, ranked from 0–100, was categorized into Low = 0–33, Medium = 34–66, and High = >66 categories for map display.

Geothermal Potential

This dataset includes polygons from the Idaho National Engineering & Environmental Laboratory (INEEL) of regions favorable for the discovery and shallow depth (less than 1,000 m) of thermal water of sufficient temperature for direct-heat applications.

Solar Potential

This polygon dataset provides information on the photovoltaic solar resource potential (US 9805 latilt) for the 48 contiguous States as published by the National Renewable Energy Laboratory (NREL). Map display categories follow those used in the Draft Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States (DES 10-59, DOE/EIS-0403; solareis.anl.gov) to show areas with an occurrence potential greater than 5.5 kWh/m^2/day (kilowatt hours per square meter per day). Reaming areas have the potential for less than 5.5 kWh/m^2/day.

Oil Shale and Tar Sands

This polygon dataset is from the 2008 Oil Shale and Tar Sands PEIS. It includes merged features from the stratigraphic unit files for oil shale in Colo., Utah, and Wyo., which have been designated as "most geologically prospective," as well as "special tar sand areas" in Utah.

Wind Potential

This polygon dataset is a consolidated annual average wind resource potential at a 50-m height from NREL State-level shapefile data. Categories for medium and high were created from the original data as follows: Medium = Fair (3 or 200–300) and High = Good (4 or 400–500), Excellent (5 or 500–600), Outstanding (6 or 600–800), and Superb (7 or >800). Original 50-m-resolution data was resampled to 5-km resolution.

Table A-1. Direct and indirect buffer distances used to represent effects of human infrastructure and activities on Greater Sage-Grouse for this Report with references to the literature describing these relations.

General Description	Data Source	Indicator	Area of Influence	Reference for Influence
Habitat Conversion to Agriculture	USDA Cropland (Categories identified by CEA Team)	Acres	Direct: polygon area Indirect: 6.9 km	Boarman and Heinrich, 1999, Leu and others, 2008, Connelly, 2011
Urbanization	Urban Areas—ESRI City Boundaries	Acres	Direct: polygon area Indirect: 6.9 km	Boarman and Heinrich, 1999, Leu and others, 2008
Infrastructure (Power lines)	Global Energy/ Platts, Market significant power lines (gen >115kV) & assoc. structures	Acres	Direct: 200 meters Indirect: 6.9 km	Ellis 1985, Connelly and others, 2004, Bradley and Mustard, 2006, Boarman and Heinrich, 1999, Leu and others, 2008
Infrastructure (Comm. Towers)	FCC	Acres	Direct: 1 ha (56.4 m) Indirect: 6.9 km	Boarman and Heinrich, 1999, Leu and others, 2008
Infrastructure (Other Vertical Structures)	FAA (non-wind)	Acres	Direct 1 ha (56.4 m) Indirect: 6.9 km	Boarman and Heinrich, 1999, Leu and others, 2008
Infrastructure (Fences)	BLM Range Allotment GSSP	Miles	Direct: Miles	Stevens and others, 2012
Infrastructure (Roads)	ESRI Roads (Interstate, Federal and State Highway, Secondary)	Acres	Direct: 73.2 m, 25.6 m, 12.4 m Indirect: 7.5 km, 3 km, 3 km	Holloran, 2005, Lyon, 2000, Connelly and others, 2004
Infrastructure (Railroads)	ESRI Railroads	Acres	Direct: 9.4 m Indirect: 3 km	Knick and others, 2011
Fire History	NIFC (Fire Polygons, 2001–2012)	Acres	Direct: Fire Acres	
Invasive Plant (Exotic Annual Grass)	Model—Cheatgrass (Great Basin only)	Acres	Direct: High and Moderate Probability Polygons	Meinke and others, 2009
P-J (Conifer) Encroachment	Northern Great Basin Assessment Model	Acres	Direct: 120m	DOI, 2010
Grazing (Domestic Livestock)	BLM Allotments (not meeting Land Health Standards [habitat due to livestock grazing])	Acres	Direct: “not meeting” Polygon Areas	
Grazing (Wild Horses & Burros)	BLM HMAs (GSSP), FS HMAs	Acres	Direct: Polygon Areas	

Table A-1. Direct and indirect buffer distances used to represent effects of human infrastructure and activities on Greater Sage-Grouse for this Report with references to the literature describing these relations.—Continued

General Description	Data Source	Indicator	Area of Influence	Reference for Influence
Energy (Nonrenewable; O&G)	IHS Well location data (non-plugged, or plugged only in the last 10 years)	Acres	Direct: 3 acres Indirect:19 km	Walker and others, 2007, USFWS, 2008, Johnson and others, 2011, Taylor and others, 2012
Energy (Nonrenewable; Coal)	BLM State Offices (Surface Mines)	Acres	Direct: Polygon Areas Indirect: 19 km	Johnson and others, 2011, Taylor and others, 2012
Mining (Locatable Mining Claims)	BLM State Offices—WO 300 Data Call	Acres	Direct: Polygon Areas Indirect: 2.5 km	Bradley and Mustard, 2006
Mining (Mineral Materials Disposal Sites)	BLM State Offices—WO 300 Data Call	Acres	Direct: Polygon Areas Indirect: 2.5 km	Bradley and Mustard, 2006
Energy (Renewable—Wind)	FAA	Acres	Direct: 3 acres (62m buffer) Indirect: 6.9 km	Bradley and Mustard, 2006, Boarman and Heinrich, 1999, Leu and others, 2008
Energy (Renewable—Geothermal)	BLM State Offices	Acres	Direct: Polygon Areas	Johnson and others, 2011, Taylor and others, 2012

Table A-2. Internal (BLM) data sources.

Analysis Dataset	Source	Data Type	Publication Date or Received Date	Data Currency Date
Base and Greater Sage-Grouse Habitat				
BLM Land Use Plans (LUP)	BLM Geospatial Services Strategic Plan (GSSP)	Polygon	June 2012	June 2012
BLM Subsurface Minerals Administration	BLM State offices: CO, MT, UT, WY	Polygon	May 2012	May 2012
Federal Surface Management Agency	BLM GSSP	Polygon	May 2012	May 2012
Forest Service Administrative Units	USFS Enterprise Data Warehouse	Polygon	July 2012	July 2012
GRSG Planning Regions and EIS Boundaries	Derived from BLM Land Use Plans GSSP	Polygon	May 2012	May 2012
Conservation				
ACEC	BLM GSSP	Polygon	May 2012	May 2012
NLCS (National Conservation Areas, Wilderness Study Areas, National Monuments, Cooperative Management and Protection Areas, Outstanding Natural Areas, and Forest Reserves)	BLM GSSP	Polygon	June 2012	July 2009
Wilderness (BLM)	BLM GSSP	Polygon	June 2012	July 2009
Wilderness (USFS)	USFS[1] Enterprise Data Warehouse	Polygon	April 2012	April 2012
Current Threat				
Coal Leases	Individual BLM State, District and Field offices	Polygon	November 2011–May 2012	November 2011–December 2012
Decadal Fires—Fire Perimeters, 2000–2012	Geospatial Multi-Agency Coordination (GeoMAC) Group	Polygon	January 2013	December 2012
Fences (BLM)—Grazing Allotments and Pastures	BLM GSSP	Line (converted from polygon)	May 24, 2012	May 24, 2012
Fences (USFS) —Grazing Allotments and Pastures	USFS Enterprise Data Warehouse	Line (converted from polygon)	July 2012	July 2012
Geothermal Leases	Individual BLM State, District and Field offices	Polygon	November 2011–May 2012	Varies 2009–2011
Grazing (BLM)—allotment/pasture designations	Veblen, K.E. and others, 2011, Assal, T.J. and others, 2012, BLM GSSP grazing allotment and pasture polygons	Polygon	May 24, 2012	May 24, 2012
Grazing (BLM)—Land Health Standards	Veblen and others, 2011, Assal and others, 2012, BLM GSSP	Polygon	May 24, 2012	2008
Grazing (USFS)	USFS[1] Enterprise Data Warehouse	Polygon	July 2012	July 2012
Mining and Mineral Materials Disposal—Mineral-Material Disposal Sites and Locatable Mining Claims	Individual BLM State, District and Field offices	Polygon	November 2011–December 2012	November 2011–December 2012

Table A-2. Internal (BLM) data sources.—Continued

Analysis Dataset	Source	Data Type	Publication Date or Received Date	Data Currency Date
Oil & Gas Wells (AFMSS)	BLM Automated Fluid Minerals Support System (AFMSS) Database	Point	December 2012	December 2012
Wild Horse and Burro Areas (USFS)	USFS[1] Enterprise Data Warehouse	Polygon	May 2012	May 2012
Wild Horse and Burro Herd Management Areas (BLM)	BLM GSSP	Polygon	May 2012	May 2012
Valid Existing Rights				
Federal Fluid Minerals—Areas Closed to Oil and Gas Leasing	Individual BLM State, District and Field offices	Polygon	November 2011–December 2012	November 2011–December 2012
Oil and Gas leases	Individual BLM State, District and Field offices	Polygon	October 2011–May 2012	October 2011–May 2012
Oil and Gas leases—Held by Production	Individual BLM State, District and Field offices	Polygon	October 2011–May 2012	October 2011–May 2012
Oil Shale Leases	Individual BLM State, District and Field offices	Polygon	November 2011–December 2012	Varies 2007–2012
Solar Right of Ways—Approved and Authorized	Individual BLM State, District and Field offices	Polygon	November 2011–May 2012	Varies 2011–2012
Wind Energy Rights of Way—Approved and Authorized	Individual BLM State, District and Field offices	Polygon	November 2011–May 2012	Varies 2011–2012
Potential Threat				
Fire Probability	USFS[1]—Missoula Fire Sciences Laboratory, Fire Program Analysis System, "High" category, NIFC	Raster	May 2012	September 2011

[1] The U.S. Forest Service makes no warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose, nor assumes any legal liability or responsibility for the accuracy, reliability, completeness or utility of these geospatial data, or for the improper or incorrect use of these geospatial data. These geospatial data and related maps or graphics are not legal documents and are not intended to be used as such. The data and maps may not be used to determine title, ownership, legal descriptions or boundaries, legal jurisdiction, or restrictions that may be in place on either public or private land. Natural hazards may or may not be depicted on the data and maps, and land users should exercise due caution. The data are dynamic and may change over time. The user is responsible to verify the limitations of the geospatial data and to use the data accordingly.

Table A-3. External data sources

Analysis Dataset	Source	Data Type	Publication Date or Received Date	Data Currency Date	
Base and Greater Sage-Grouse Habitat					
Preliminary General Habitat	Individual State BLM offices and State wildlife agencies	Polygon	September 2011–June 2012	June 2012	*http://www.blm.gov/wo/st/en/prog/more/sagegrouse/documents_and_resources.html*
Preliminary Priority Habitat	Individual State BLM offices and State wildlife agencies	Polygon	September 2011–June 2012	June 2012	*http://www.blm.gov/wo/st/en/prog/more/sagegrouse/documents_and_resources.html*
WAFWA management zones, Version 2	Western Association of Fish and Wildlife Agencies	Polygon	October 2006	October 2006	*http://sagemap.wr.usgs.gov/ftp/SAB/sg_mgmtzones_ver2_20061018.zip*
Current Distribution of sage-grouse	Western Association of Fish and Wildlife Agencies	Polygon	February 2002	1999	*http://sagemap.wr.usgs.gov/FTP/regional/USGS/Sage-grouse_distribution_sgca.zip*
Sage-grouse Breeding Bird Density	BLM		August 2010	August 2010	*http://www.blm.gov/wo/st/en/prog/more/fish__wildlife_and/sage-grouse-conservation/bird_density.html*
Sage-grouse Populations	Western Association of Fish and Wildlife Agencies	Polygon	2004	2004	*http://sagemap.wr.usgs.gov/ftp/sab/sg_subpopulations.zip* and *http://sagemap.wr.usgs.gov/ftp/sab/sg_populations.zip*
Sage-grouse lek spatial connectivity	USGS (SAB)	Polygon	June 2010	December 2007	*http://sagemap.wr.usgs.gov/ftp/sab/sg_components.zip*
Distribution of sagebrush	Western Association of Fish and Wildlife Agencies	Polygon	2011	2006	*http://sagemap.wr.usgs.gov/ftp/sab/allsage_90m.zip*
Sage-grouse Genetic Sampling Sites	Oyler-McCance and others, 2005b	Point	2005	2005	See Oyler-McCance and others, 2005b
Sagebrush Biomes	Western Association of Fish and Wildlife Agencies	Polygon	2004	2004	*http://sagemap.wr.usgs.gov/FTP/regional/USGS/floristic_provinces_sgca.zip*
Conservation					
Conservation Easements	National Conservation Easement Database, Version 1	Polygon	August 2011	August 2011	*http://databasin.org/*
NPS Lands	Protected Areas Database, V 1.2	Polygon	April 2011	February 2011	*http://gapanalysis.usgs.gov/padus/data/*
Private Conservation Lands	Protected Areas Database, V 1.2	Polygon	April 2011	February 2011	*http://gapanalysis.usgs.gov/padus/data/*
Wilderness (NPS and FWS)	Protected Areas Database, V 1.2	Polygon	April 2011	February 2011	*http://gapanalysis.usgs.gov/padus/data/*
Wildlife Refuges (Other)	Protected Areas Database, V 1.2	Polygon	April 2011	February 2011	*http://gapanalysis.usgs.gov/padus/data/*
Wildlife Refuges (USFWS)	National Wildlife Refuge Boundary and Parcel Data	Polygon	April 2011	May 2011	*http://www.fws.gov/GIS/data/CadastralDB/FWS_Refuge_Boundaries.zip*

Table A-3. External data sources.—Continued

Analysis Dataset	Source	Data Type	Publication Date or Received Date	Data Currency Date	
Current Threat					
Agriculture—Cropland	National Agricultural Statistics Service Cropland Data Layer, crop categories	Raster	June 2012	2011	*http://nassgeodata.gmu.edu/CropScape/*
Cheatgrass Probability Model	Meinke and others, 2009; Mike Pellant, personal communication	Polygon	June 2012	2008	*http://sagemap.wr.usgs.gov/ftp/sab/cheat_dec.zip*
Communication Towers	Federal Communications Commission	Point	July 2009	April 2009	*http:/wireless.fcc.gov/geographic*
Oil & Gas Wells (buffered points)	Enerdeq IHS database	Point	December 2011	October 2001–November 2011	*Licensed proprietary data set http://www.ihs.com/products/oil-gas-information/index.aspx*
Pinyon-Juniper & Conifer Encroachment (derived)	National GAP Analysis Program	Raster	February 2010	February 2010	*http://gapanalysis.usgs.gov/*
Power lines (>115kv) and Associated Structures	EV Energy Map, Platts/Global Energy	Line	September 2005	September 2005	Licensed proprietary data set *http://www.platts.com*
Power lines in the Western United States, 2004	ICBEMP existing utility corridors data set	Line	2004	2003	*http://sagemap.wr.usgs.gov/ftp/regional/usgs/powerlines_hf.shp*
Railroads	Federal Railroad Administration (FRA) Rail Lines of the USA	Line	July 2011	July 2011	*http://app.databasin.org/app/pages/datasetPage.jsp?id=6d8a6878c3004fb38e59a6b08f965d5a*
Roads (interstates, highways, and secondary)	Tele Atlas ESRI StreetMap Premium for ArcGIS v 9.0, Dynamap Transportation version 5.2, 2003	Line	April 2008	July 2003	ESRI Data & Maps is available only as part of ESRI® software.
Urbanized Areas—City Limits	Tele Atlas ESRI StreetMap Premium for ArcGIS v 9.0	Polygon	April 2008	April 2008	ESRI Data & Maps available as part of ESRI® software.
Vertical Structures	Federal Aviation Administration Digital Obstacles File	Point	December 2011	September 2011	*https://nfdc.faa.gov/tod/public/TOD_DOF.html*
Water Developments	BLM Rangeland Improvement Project Database	Polygon	October 2007	October 2007	*http://sagemap.wr.usgs.gov/ftp/sab/Water_Developments_RIPS.zip*

Table A-3. External data sources.—Continued

Analysis Dataset	Source	Data Type	Publication Date or Received Date	Data Currency Date	
Wind Towers	Federal Aviation Administration Digital Obstacles File	Point	December 2011	September 2011	*https://nfdc.faa.gov/tod/public/TOD_DOF.html*
Potential Threat					
Coal Potential	Americas Coal Potential—USGS	Polygon	January 2008	January 2006	*http://pubs.usgs.gov/of/2008/1257*
Geothermal Potential	Idaho National Engineering & Environmental Laboratory	Polygon	November 2003	May 2003	*www.inel.gov*
Oil and Gas Potential	Copeland, H., K. Doherty, D. Naugle, A. Pocewicz, J. Kiesecker (2010) Mapping Oil and Gas Development Potential	Raster	2009	2009	*http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0007400*
Oil Shale and Tar Sands	Oil Shale and Tar Sands Programmatic Environmental Impact Statement (PEIS)—Argonne National Laboratory	Polygon	2008	1980–2008	*http://ostseis.anl.gov/guide/maps/index2008.cfm*
Solar Potential	National Renewable Energy Laboratory	Polygon	December 2005	December 2005	*http://www.nrel.gov/gis/data_solar.html*
Wind Potential	National Renewable Energy Laboratory	Polygon	December 2010	2003	*http://www.nrel.gov/gis/data_wind.html*

Table A-4. Summary of research documenting specific consequences, land-use development, and anthropogenic activities and infrastructure on Greater Sage-Grouse.

Threat or Issue	Location	Comparison	Covariate Investigated	Spatial Scale(s) Investigated	Sage-Grouse Response	Comment	Source
Agricultural Conversion	Wyoming, Montana, and Colorado	Lek count comparison	Proportion of land area converted from sagebrush	Variable scales surrounding leks	Conversion of ≥16% of sagebrush-dominated area around leks correlated with a 50 to 100% decline in male lek occupancy	Review of several studies	Swenson, 1987
Agricultural Conversion	Historic range	Currently occupied compared to unoccupied	Proportion of land area in cropland	2,975 km^2 around random points	Cropland exceeding 25% associated with extirpated range		Aldridge, 2008
Agricultural Conversion	Historic range	Currently occupied compared to unoccupied	Proportion of land area in cropland	1,018 km^2 around random points	Sagebrush cover <27% associated with extirpated range	Extirpated range had 3 times more area in agriculture compared to occupied range	Wisdom, 2011
Agricultural Conversion	Montana	Lek count comparison	Proportion of land area in cropland	202 km^2 of study area	Conversion of 30% of sagebrush-dominated habitat patches resulted in 73% decline in number of breeding males on leks	Habitats converted were used by sage-grouse predominantly in winter	Swenson, 1987
Agricultural Conversion	Current range	Lek count comparison	Proportion of land area in cropland	5 km (79 km^2) and 18 km (1,018 km^2) buffers of leks	Decline in lek trends to 2.5% of the area within 5 km or 1.5% of the area within 18 km of leks was cropland	Lek counts stabilized as percent cropland increased beyond these proportions; few leks occurred in areas where proportion of agricultural land exceeded 50%	Johnson, 2011
Infrastructure—Roads	Wyoming, Utah	Lek activity comparison	Distance to Interstate 80	7.5 km and 15 km buffer of Interstate 80	No leks within 2 km of the interstate; reduced numbers of leks within 7.5 km of the interstate compared to numbers of leks 7.5 to 15 km from interstate		Connelly, 2004
Infrastructure—Roads	Wyoming, Utah	Lek count comparison	Distance to Interstate 80	7.5-km and 15-km buffer of Interstate 80	Higher rates of decline in the number of males on leks (1970–2003) within 7.5 km compared to leks 7.5 to 15 km from the interstate		Connelly, 2004

Table A-4. Summary of research documenting specific consequences, land-use development, and anthropogenic activities and infrastructure on Greater Sage-Grouse.—Continued

Threat or Issue	Location	Comparison	Covariate Investigated	Spatial Scale(s) Investigated	Sage-Grouse Response	Comment	Source
Infrastructure—Roads	Montana, Canada	Comparison of occurrence of large (>25 males) vs. small leks	Length of road (road density)	3.2-km buffer of leks	Probability of occurrence of large lek approached 0% as the length of road exceeded 100 km		Tack, 2009
Infrastructure—Roads	Colorado	Lek count comparison	Traffic volumes	Unspecified	Increased traffic (coal mine road upgrade) correlated with 94% decline in number of sage-grouse over a 5-year period on leks <2 km from road		Remington and Braun, 1991
Infrastructure—Roads	Wyoming	Lek count comparison	Traffic volumes	3-km buffer of leks	Decline in lek counts positively correlated with increased traffic volumes	Vehicle activity on roads when grouse present on leks had greater influence on male lek attendance compared to roads with no vehicle activity during this period	Holloran, 2005
Infrastructure—Roads	Wyoming	Females breeding on impacted vs. unimpacted leks; nest site selection	Impacted leks within 3 km of road	N/A (study area)	Females from impacted leks: had 24% lower probability of initiating a nest; moved twice as far from lek to nest; were less likely to initiate nests in consecutive years compared to females from non-impacted leks		Lyon, 2003
Infrastructure—Transmission Lines	Utah	Lek count comparison	Distance to transmission line	200-m buffer of leks	72% decline in number of sage-grouse on a lek 2 years post-transmission line erection	Daily dispersal patterns from a lek during breeding season disrupted	Ellis, 1985
Infrastructure—Transmission Lines	Colorado	Pellet occurrence	Distance to transmission line	Unspecified	Pellet occurrence increased as distance from transmission line increased up to 600 m		Braun, 1998

Table A-4. Summary of research documenting specific consequences, land-use development, and anthropogenic activities and infrastructure on Greater Sage-Grouse. —Continued

Threat or Issue	Location	Comparison	Covariate Investigated	Spatial Scale(s) Investigated	Sage-Grouse Response	Comment	Source
Infrastructure—Power Lines	Wyoming	Lek activity comparison	Distance to power line; Proportion of land area within 350 m of power line	Multiple buffers to 6.4 km (129 km^2) of leks	Probability of an active lek decreased with closer proximity to poles and increasing proportion of area within 350 m of power line within 6.4 km of lek		Walker, 2007
Infrastructure—Transmission Lines	Wyoming	Sage-grouse female nesting and brood-rearing (early and late) occurrence	Distance to transmission line	N/A (study area)	Sage-grouse avoided brood-rearing habitats within 4.7 km of transmission line		LeBeau, 2012
Infrastructure—Fences	Idaho	Collision occurrence	Lek size; Distance to lek; Topography; Fence density	2.5-km buffer of leks	Probability of collision higher in areas with (1) increased fence density; (2) decreased distance to nearest lek; (3) increased lek size; (4) lower topographic ruggedness	Collisions more common on fences constructed of steel t-posts and/or with large distances between posts (decreased visibility)	Stevens, 2011, Stevens, 2012
Energy development—Natural gas	Eastern range of species	Lek count comparison	Well pad densities	3.2-km buffer of leks	Well pad densities exceeding 1 pad/mi^2 (section) negatively influence number of sage-grouse on leks	Review of several studies	Naugle, 2011
Energy development—Natural gas	Wyoming	Lek count comparison	Well pad densities	8.5-km buffer of leks	Impacts to the number of sage-grouse on leks found at well pad densities >0.4 to 0.8 well pads/km^2 (0.15 to 0.3 pads/section)	Common well pad densities of 1.5 and 3.1 pads/km^2 (4 and 8 pads/section) associated with lek count declines ranging from 13–74% and 77–79%, respectively	Harju, 2010

Table A-4. Summary of research documenting specific consequences, land-use development, and anthropogenic activities and infrastructure on Greater Sage-Grouse.—Continued

Threat or Issue	Location	Comparison	Covariate Investigated	Spatial Scale(s) Investigated	Sage-Grouse Response	Comment	Source
Energy development—Natural gas	Wyoming	Lek activity comparison	Well pad densities	1-km buffer of leks	0% probability of lek occurrence when well pad densities exceeded 6.5 pads/mi^2 (section)		Hess, 2012
Energy development—Natural gas	Montana, Canada	Comparison of occurrence of large (>25 males) vs. small leks	Well pad densities	12.3-km buffer of leks	Large leks did not occur in areas where well pad densities exceeded 2.5 pad/mi^2 (section)		Tack, 2009
Energy development—Natural gas	Wyoming	Lek count comparison	Distance to well pads (pad presence (1) vs. absence (0) within buffers of leks)	Multiple buffers to 4.8 km of leks	Well pads within smaller buffers (<1.6–2 km) around leks associated with 35–76% fewer sage-grouse on leks compared to leks with no well pads within these buffers	Leks that had at least 1 well pad within 0.4 km had 35 to 92% fewer sage-grouse compared to leks with no well pads within this buffer	Harju, 2010
Energy development—Natural gas	Eastern range of species	Lek count comparison	Distance to well pads	N/A (study area)	Impacts to the number of males on leks were most severe when infrastructure occurred near leks; impacts remained discernible out to distances of 6.2 to 6.4 km	Review of several studies	Naugle, 2011
Energy development—Natural gas	Wyoming	Sage-grouse female nesting occurrence	Distance to well pads	N/A (study area)	Yearling females avoided nesting within 950 m of well pads		Holloran, 2010
Energy development—Natural gas	Wyoming	Sage-grouse female nesting and brood-rearing (early and late) occurrence	Distance to well pads; proportion of buffer disturbed by gas development activities	Multiple buffers to 1.26 km (5 km^2) of seasonally selected sites	Females avoided nesting and brood-rearing in areas with increased numbers of visible wells within a 1-km^2 area; females avoided sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%		Kirol, 2012

Table A-4. Summary of research documenting specific consequences, land-use development, and anthropogenic activities and infrastructure on Greater Sage-Grouse.—Continued

Threat or Issue	Location	Comparison	Covariate Investigated	Spatial Scale(s) Investigated	Sage-Grouse Response	Comment	Source
Energy development—Natural gas	Wyoming	Sage-grouse chicks survival	Proportion of buffer disturbed by gas development activities	Multiple buffers to 1.26 km (5 km^2) of seasonally selected sites	Chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4%		Kirol, 2012
Energy development—Natural gas	Canada	Sage-grouse chicks survival	Well pad densities	Multiple buffers to 1 km (3 km^2) of seasonally selected sites	Chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations		Aldridge and Boyce, 2007
Energy development—Natural gas	Canada	Sage-grouse winter occurrence	Distance to well pads	N/A (study area)	Sage-grouse avoided habitats within 1.9 km of infrastructure during winter		Carpenter and others, 2010
Energy development—Wind	Wyoming	Sage-grouse nest and chick survival	Distance to wind turbine	N/A (study area)	Nest and chick survival decreased as distance to turbine decreased	Study investigated the short-term response of sage-grouse to a wind energy facility; impacts of the facility may not be realized within time-frame of study	LeBeau, 2012
Habitat Fragmentation	Idaho	Movement patterns		N/A (study area)	Sage-grouse used an annual range of at least 2,764 km^2		Leonard, 2000
Habitat Fragmentation	Historic range	Currently occupied compared to unoccupied	Proportion of land area in cropland	1,018 km^2 around random points	Sagebrush patch size in occupied range averaged 4,173 ha		Wisdom, 2011
Habitat Fragmentation	Idaho, Wyoming	Movement patterns		N/A (study area)	Sagebrush patch sizes >4,000 ha required for successful reproduction and over-winter survival		Leonard, 2000, Walker, 2007
Habitat Fragmentation	Wyoming	Movement patterns		N/A (study area)	314-km^2 area necessary to maintain breeding habitat around a single lek		Doherty, 2008

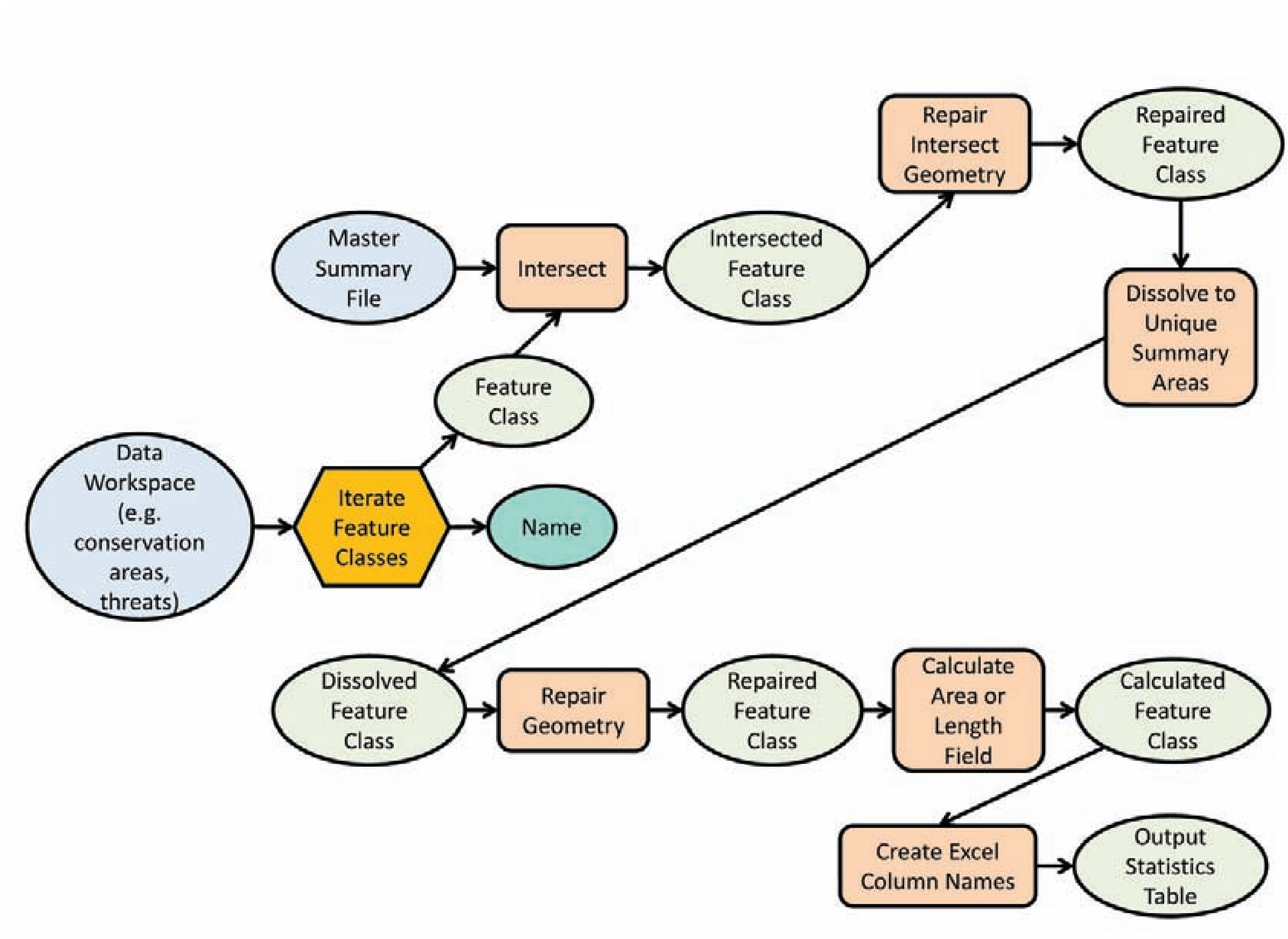

Figure A-1. Model-builder process flowchart.

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Dynamics of Greater Sage-grouse (*Centrocercus urophasianus*) Populations in Response to Transmission Lines in Central Nevada

Progress Report: Year 9

December 2011

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ABSTRACT We monitored greater sage-grouse (*Centrocercus urophasianus*) associated with13 breeding leks to characterize demographic processes in a ~6500 km^2 area in Eureka County, Nevada. The long-term goal of this ten-year study is to assess the impact of NV Energy's Falcon-Gondor transmission line on sage grouse population dynamics. We used mark-recapture, lek observations, nest & brood monitoring, vegetation sampling, and radio telemetry to estimate key demographic parameters. We have banded a total of 1287 unique sage grouse during the nine years of the study. Additionally, we have radio-collared 199 female and 61 male sage-grouse during this time. We have also monitored 373 nests, of which 119 were successful. From 2009-2011, we captured and marked 352 chicks at hatch and recaptured 67 of the marked chicks at approximately one month of age. From 2003-2007, counts of common ravens along the transmission line corridor and raven-associated disturbances at leks increased dramatically, however, in 2008 raven counts declined to levels observed immediately following line construction. Raven counts have since rebounded and in 2011 counts approached 2007 levels.

We used our male banding data to evaluate the relative importance of annual variation in resource availability, as indexed by normalized difference vegetation indices (NDVI), to sage-grouse population dynamics. Annual variation in NDVI had a strong positive influence on per-capita recruitment (β = 0.78; 95% CI = 0.37 to 1.19), and recruitment was over 9-times greater following the year of highest NDVI (f = 0.77 ± 0.18 SE) compared to the year of lowest NDVI (f = 0.08 ± 0.03 SE). We found a similar positive influence on male survival, but the effect was not as strong (β = 0.28; 95% CI = -0.07 to 0.62) as for recruitment. Using this analysis we also demonstrated negative effects of exotic grassland footprint on lek-level recruitment (β = -0.62; 95% CI = -0.82 to -0.41) and annual survival (β = - 0.29; 95% CI = -0.55 to -0.03).

We also used our male banding data to estimate differences in lek attendance and survival between males with radio-collars and banded-only males. Model average results indicate radio-collared male sage-grouse were less likely to attend a lek in a given year (γ=0.702 ± 0.201 SE) or less likely to be detected on a lek (P*= 0.332 ± 0.153 SE) if present than banded-only males (γ=0.275 ± 0.219 SE; P*= 0.615 ± 0.155 SE). Although results suggested a significant impact of radio-collars on male breeding behavior, no substantial support for an influence of radio-collars on male survival was found.

We evaluated the utility of lek counts for estimating annual and long term population trends, using our male banding data to generate independent estimates of population growth (λ) and male breeding propensity. A linear regression comparing annual lek count trends to realized λ, annual variation in breeding propensity, and unexplained error, showed that lek counts produced a good fit to realized λ (R^2 = 0.760). However, the remaining error was sufficient to cause discrepancies between lek counts and realized λ in 4 of 7 intervals. For this reason, we caution use of lek counts for making inferences regarding short-term changes in sage-grouse populations.

Female survival showed strong seasonal variation, with the lowest monthly survival occurring during the spring breeding season (March-May; Φ_B = 0.947 ± 0.007) and during the fall (August-October; Φ_F = 0.922 ± 0.009). We detected a substantial cost of reproduction on survival, where females that successfully raised ≥ 1 chick to 45 days of age had lower annual survival (Φ_A = 0.498 ± 0.057) than unsuccessful females (Φ_A = 0.610 ± 0.026). NDVI had an overall positive association with female survival; survival during the spring breeding season increased in years with higher plant production (β = 0.513; 95% CI = 0.096 to 0.930).

We evaluated factors influencing female reproductive success using a multi-state model, where female success was modeled as a function of previous year's reproductive state and

NDVI. Females who were previously successful had a higher overall probability of success (Ψ_S = 0.277 ± 0.089) compared to previously unsuccessful hens (Ψ_U = 0.094 ± 0.025). NDVI had a strong positive influence on female success (β = 1.336; 95% CI = 0.142 to 2.529), and we detected a more than 4-fold increase in success between the years of highest and lowest NDVI.

Estimated nest survival has remained relatively constant over the course of this study. Using data from 2005-2011, model averaged daily nest survival was 0.950 (± 0.009 SE) resulting in an overall probability of nest survival for a 37-day nest period of 0.149 (± 0.007 SE). Model results suggested a lower daily survival rate for the day following flushing a hen from a nest (0.908 ± 0.029 SE) compared to the day a hen was not flushed (0.950 ± 0.009 SE). However, there was not a substantial difference between overall nest survival probabilities from a nest that was flushed once (0.152 ±0.007 SE) compared with a nest that was not flushed (0.160 ±0.006 SE). We continue to find no convincing support for a meaningful impact of the Falcon-Gondor line on nest survival.

Overall we have demonstrated an important association between annual plant production (indexed by NDVI) and sage-grouse survival (males and females), reproductive success (females), recruitment (males), and population growth (males). These results highlight the important association between sage-grouse populations and climatic processes in our arid study system. We were also able to identify and quantify potential sources of bias associated with monitoring sage-grouse by modeling observer impacts on nest survival, impacts of radio-collar transmitters on male survival and behavior, and error associated with count-based indices.

INTRODUCTION

Sage-grouse populations have declined range-wide since the mid 1960's, with some states showing stabilizing trends in the past two decades (Connelly et al. 2004). Sage-grouse are an obligate of sagebrush with both adults and young using this vegetation for food and shelter throughout the year and subsisting solely on it during the winter months (Beck 1977, Dalke et al. 1963, Wallestad et al. 1975). Human disruption of the sagebrush biome has contributed to approximately 530,000 square kilometers of sagebrush steppe habitat loss (Crawford et al. 2004, Connelly et al. 2004, Dalke et al. 1963). Given the amount of sagebrush steppe lost and sage-grouse dependency on sagebrush, it is believed that the loss and degradation of habitat is an important cause of population decline (Connelly et al. 2000).

Elevated structures, such as utility lines can provide perches for avian predators that are higher than those supplied by local vegetation and topography (Ellis 1984, Braun 1998). The only post-hoc study of the impact of utility lines on sage-grouse suggested general lower lek attendance at leks closer to utility lines, but was unable to account for confounding factors that may have influenced both utility line placement and sage-grouse populations (Hall and Haney 1997). It is hypothesized that avian predators of sage grouse adults (raptors) and nests (corvids) may use utility poles and towers to increase their hunting efficiency, in turn reducing adult survival or nest success and triggering population declines in nearby leks (Hall and Haney 1997, Alstatt 1995). Alternatively, the perceived threat of predation associated with utility lines may cause sage-grouse to avoid utility lines, leading to sage-grouse abandonment leks, nest sites, and brood rearing areas near utility lines (Hall and Haney 1997, Braun 1998).

Recent indirect evidence supports an avoidance hypothesis, in that lek locations have been found to have the least long range visibility in combination with greatest short range visibility that local topography will allow (Aspbury et al. 2004). In short, male sage-grouse may be choosing lek locations that maximize their visibility to female grouse near a lek, while reducing long range visibility to predators (Aspbury et al. 2004).

In fall 2003 Sierra Pacific Power Company (now NV Energy) began construction of a 345 kilovolt transmission line between Falcon and Gondor, Nevada (FG line). Construction of the FG line was completed in the spring of 2004 and was energized in May of that year. The FG line is approximately 290 km long and has 735 towers that vary in height from 23 to 40 m, depending on topography. The FG line runs through the middle Eureka County's prime sage grouse habitat (M. Podborny, NDOW, personal communication).

OBJECTIVES

The goal of this study is to assess impacts of the FG line on population dynamics of greater sage-grouse in the region. The basic study design calls for estimation of key demographic parameters (male lek attendance over time, movement between leks, adult survival rates, nest success, brood survival, recruitment, and population size) as a function of distance from the line. Under the hypothesis that the line negatively affects local sage-grouse, we expect demographic responses to the line to be greatest for leks and/or individuals nearest the line. Distance from line will be directly incorporated into models of demographic parameters to assess this hypothesis. For parameters in which we hypothesize a time delayed response (e.g., adult survival following an increase in raptors) the appropriate analysis includes a time by distance interaction. Thus, though it may not be immediate, we expect (under the hypothesis of an impact of line) a greater decline in adult survival for leks near the line than for leks distant from the line.

To this end, several leks at varying distances from the FG line were chosen to be monitored for ten years. At each of these leks a regime of capture-mark-recapture and observations throughout the strutting season was initiated. We also radio tagged a sample of hens captured each year and followed these hens throughout the breeding, nesting, and brood-rearing seasons. From 2005-2011, we used a combination of Passive Integrated Transponder (PIT) tags and patagial tags to permanently mark sage grouse chicks. Also in 2005, we began what has become an annual fall trap with Nevada Department of Wildlife (NDOW) to increase number of radio-tagged individuals in the population, hunter band returns and number of radio tagged young.

STUDY AREA

The study site is located in east central Nevada within Eureka County (Fig. 1). It is bounded by the Cortez and Simpson Park Mountains to the west and the Diamond and Sulphur Spring Mountains to the East. This area includes Denay, Pine, Kobeh, Diamond, Horse Creek, Grass, and Garden valleys. The study area encompasses approximately 6500 km^2 of sagebrush steppe and pinyon-juniper mountain ranges with many ephemeral streams. Sage-grouse utilize two main sagebrush communities in the study area. At low elevations (< ~7000 ft), a Wyoming big sagebrush (*A. tridentata wyomingensis*) community is dominant, with pockets of black sagebeush (*A. nova*) and basin big sagebrush (*A. tridentata tridentata*), as well as rubber rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and some scattered Utah juniper (*Juniperus osteosperma*). At higher elevations (> ~7000 ft), a mixed mountain big sagebrush (*A. tridentata vaseyana*)/low sagebrush (*Artemisia arbuscula*) community is most prevalent, with some intermixed common snowberry (*Symphoricarpos albus*), western serviceberry (*Amelanchier alnifolia*), and bitterbrush (*Purshia tridentata*). Large expanses of singleleaf pinyon (*Pinus monophylla*)/Utah Juniper forest are also common in the study area and in many cases are found mid-elevation between the two sagebrush communities. Common annual and perennial forbs include phlox (*Phlox* spp.), cateyes (*Cryptantha* spp.), tansy mustard (*Descurainia pinnata*), bur buttercup (*Ceratocephala testiculata*), woolystar (*Eriastrum* spp.), lupine (*Lupinus* spp.), desert parsley (*Lomatium* spp.), and desert buckwheat (*Eriogonum* spp.). Grasses consist of blue grass (*Poa* spp.), cheatgrass (*Bromus tectorum*), crested wheat (*Agropyron cristatum*), indian rice grass (*Achnatherum hymenoides*), and squirrel tail (*Elymus elymoides*). Sage-grouse were generally associated with 2 distinct populations centered on Roberts Creek Mountain and the Cortez Mountain Range. Movements of sage-grouse between these two populations appear to be relatively infrequent.

The study area includes 120 km of the FG line and focuses on thirteen active leks at various distances from the FG line (Fig. 1). Five of these leks have been monitored by NDOW and Bureau of Land Management (BLM) for the past thirty years. Long term data show male lek attendance at these leks has been declining since the early '70s with some signs of stabilization in the late '90s (Fig. 2).

METHODS

Field Methods

Mark Recapture - The predominant trapping method used to capture adult sage grouse was night spotlighting (Giesen et al. 1982). We used a high candlepower spotlight to disorient birds while a dip net was placed over them, with white noise generated throughout to mask researcher movement. Binoculars and eyeshine were used to increase the distance at which birds are detected (Wakkinen et al. 1992). To supply power for the spotlight and white noise we used either an ATV or a portable generator strapped to a backpack frame. Small diameter mesh (Giesen et al. 1982) or rubber netting was used to decrease damage to plumage. Other methods were tried such as ground mounted rocket nets (Giesen et al. 1982) and walk-in traps (Schroeder et al. 1991), but were not as successful.

During the breeding season, we captured individuals on each study lek and surrounding area approximately once a week. During the late summer/early fall trap, known brood rearing areas and ridges were scouted one week before the trap, and then intensively trapped for three nights during the new moon in August or September. Upon capture, birds were aged, sexed, weighed, and a series of morphological measurements were taken (length of 1st primary, 5th primary, wing chord, tarsus, foot, and number of tail feathers). Each bird was banded with a National Band and Tag metal band, size 16 for males and 14 for females (Walsh 2002), and all adults and those young that were large enough were banded with a colored plastic band engraved with three character alpha-numeric code for re-sighting during lek observations. All hens captured during the lekking season and a subset of hens captured during the fall trap were fitted with a radio collar. A subset of males were radio tagged in both spring and fall. We used radios from Advanced Telemetry Systems, model number A4060. Each radio weighed approximately 22 g, had a battery life of 383-766 days, and a range of 1-5 miles depending on terrain.

Lek Observations - We monitored ten viable leks in 2003, eleven leks in 2004 & 2005 twelve leks in 2006 & 2007, and 13 leks in 2008-2010, within 20 km of the transmission line. Six leks were within 5 km of the FG line and seven leks were greater than 5 km away. Leks were selected by evaluating previously collected data from BLM and the NDOW. Precise locations of monitored study leks are shown in Figure 1.

Each study lek was observed approximately once a week throughout the breeding season, March through May. Observers arrived on the leks 1/2 hour before first light, and remained until strutting activity ceased or birds disbursed (Walsh 2002). During these periods, researchers monitored leks from mobile blinds with high-powered (15x60) spotting scopes and binoculars. We occasionally included a mobile observation tower to facilitate band reading where terrain permitted and vegetation characteristics required it. In 2011, we placed trail cameras on leks to generate additional band reads. We counted the number of males and females, marked and unmarked, on leks every 30 minutes during each observation period. We also recorded individual band codes (resights) and behavioral interactions with potential predators. For lek disturbances, bird behavior, time, number of birds affected, and type of predator/disturbance were recorded.

Radio Telemetry - During the nesting season (late March to mid June) each hen was located at least once weekly either visually or by triangulation. Nesting hens were monitored twice weekly, and hens with broods were monitored once a week until 45 days post hatch (Schroeder 1997). Following nest failure hens were returned to the breeding season regime above. If a nest failed after strutting ceased the hen was monitored for survival approximately once a week. After all radio-collared hens had fledged their young or failed, they were monitored approximately once a month using fixed-wing aircraft until the next breeding season. In 2008, 2009, and 2010, all birds were monitored more intensively from August – October to document patterns in fall mortality (further description and results in Blomberg et al. 2010).

Nest Monitoring & Vegetation Sampling - Upon locating a nesting hen, a visual check point at least twenty meters away was marked with a cairn of rocks or local debris and a GPS point recorded. If environmental conditions were favorable (no storm on the horizon and no predators seen nearby) the hen was approached and flushed from the nest. Size of clutch was recorded, eggs were floated to determine stage of incubation, and each egg's length & width was measured. Age of each nest was estimated using egg float data, assuming incubation began with laying of the last egg and one egg was laid every 1.3 days (average laying time per egg [Dalke et al. 1963]). Within 24 hours the nest was checked again from a distance to confirm the hen's return. Nest monitoring followed a twice weekly regime until hatch or failure. A nest was determined successful/hatched if the hen was located nearby with chicks or if at least one egg was present with crown removed and/or the shell membrane was present and detached.

Vegetation was measured at each nest site within 3 days of hatch, or on the predicted hatch date for failed nests. We placed two perpendicular 10 m transects centered at the nest and recorded the percent shrub cover for each meter along the transect (Gregg 1994). In addition, five 20 X 50 cm Daubenmire plots were placed along each transect, where percent cover of grass and forbs was estimated and all plants were measured and identified to species. The same data collected for the Daubenmire plots were also collected for the m^2 area around the nest bowl (Sveum 1998). These same vegetation measurements are also made at 24 random points, located throughout the study area each year.

Brood Trapping, Monitoring, & Vegetation - Within three days of hatch broods were trapped and processed (Gregg 2001). Like Gregg (2001) we found hens to still be brooding their young during the hours before dawn within 2 to 3 days after hatch. Hens were flushed and the young were gathered by hand and placed in a cloth sack, which was then placed inside a researcher's jacket to maintain chick body temperature. Processing involved weighing the individual chicks, measuring their tarsus, foot, and length of bill to back of the head, as well as uniquely marking each individual (Carver et al. 1999, Becker et al. 1997). In 2005 and 2006 we used passive integrated transponder (PIT) tags. In 2007 we included patagial wing tags (#1 fish fingerling tags), and double marked all chicks with one PIT and one wing tag. In 2008 we completely shifted to using only patagial wing tags in both wings, and continued this practice through 2011. After processing, chicks were placed in another cloth sack which was also placed inside a researcher's jacket and checked periodically to determine condition. Once processing was completed, the entire brood was released together and researchers moved away from the brood in the direction opposite where the hen was last heard or seen. Throughout processing the brood the hen's position was periodically determined via radio or visual check, and we remained in the area long enough to confirm reassociation of the hen and chicks.

After capture, broods were checked once a week, hens were flushed and chicks counted to determine fledging and survival rates. In 2008, we modified brood check procedures to increase the precision of our brood count estimates. From initial capture to ~ 30 days of age, each brood was flushed weekly during the early morning while the chicks were still congregated near the hen. Following 30 days, chicks were counted while roosting at night using a spotlight and binoculars/spotting scope. We continued to collect a daytime location once a week for vegetation monitoring, however lower importance was placed on obtaining a mid-day flush count. Each daytime location was recorded using a GPS and we returned in 3-6 days to measure vegetation. Vegetation measurements were the same as those for 10 m nest transects. In addition to the vegetation measurements, we placed 5 pit traps filled with nontoxic glycerin glycol along one of the transect lines to assess arthropod densities (Gregg 2001).

In 2009 we began recapturing chicks at ~ 28 days of age to measure growth rates and collect feather samples for stable isotope analysis, and in 2011 we began additional recaptures of chicks at ~ 45 days and ~80 days of age to calculate more precise estimates of chick survival.

. We located broods at night using the hen's radio signal, and attempted to capture as many chicks from the brood as possible using our normal spotlighting techniques as described above. Captured chicks were identified by their patagial tags, weighed, and measures of head, foot, tarsus, and wing chord were taken. On the 28 day recapture occasion, we collected feathers from the secondary, lower, mid and upper covert, scapular, and back feather tracts for stable isotope analysis. On the 80 day recapture occasion, female chicks that were large enough were equipped with an 11-gram radio-transmitter.

Raptor/Corvid Surveys - Three transects were located along the FG line in the north, central, and southern portions of the study area. The northern transect had 9 points, the central had 9 points, and the southern had 5 points. We attempted to survey each transect once every 10 days. Starting times (1 hr after sunrise or at 13:00 hrs) and starting direction (north or south) were alternated. Surveys were not conducted if there was precipitation, fog, or if wind speeds exceeded 19 km/hr. Observers spent 10 minutes at each point, identified all raptor and corvid species, number of individuals, activity (perched or flying), location if perched (power line, deterrent, fence, etc), and whether it was within ¼ mile of the line or beyond.

Predator Indices - In 2011, we instituted the use of trail cameras to develop indices of nest predator abundance and evaluate correlations between predator abundance and road densities. We created two sets of random camera locations per survey area located < 30m and >50m from a road. Cameras were placed within 4 survey areas to include low elevation habitat (Kobeh and Pine valleys) and high elevation habitat (Roberts Creek Mountain and the Potato Patch/Cottonwood Canyon area) associated with the Roberts Creek and Cortez populations of sage-grouse. Camera locations were randomly generated using ArcGIS and cameras were deployed from 3-5 days at each location. Cameras were baited with a scent-bait comprised of a mixture of rotting chicken, tuna, and various commercially available coyote lures. Cameras were oriented north or south to minimize random pictures caused by movement of the sun, were set at low sensitivity, and to take a burst of three pictures with a five-minute cool down between bursts.

Quantitative Analyses

For 2011 we've conducted demographic analyses in Program MARK (White and Burnham 1999) using data from our marked individuals to answer specific research questions regarding various sage-grouse life history stages. We will discuss the specific MARK models briefly, and then focus on each individual life stage analysis.

Male analyses – Using our male banding data, we have conducted a Pradel model analysis to estimate population growth and recruitment of males, and a robust design analysis to estimate rates of annual lek attendance and annual survival. Pradel models allow for direct estimation of population growth rate (λ) and recruitment (*f*) from capture recapture data using a reverse-time sampling approach (Pradel 1996). Robust design models estimate rates of temporary emigration by dividing encounters of marked individuals into primary (e.g., a calendar year) and secondary (e.g., months within the year) occasions, where the population in considered open between primary occasions, but assumed to be closed among secondary occasions within each primary occasion. This allows for estimation of temporary emigration (γ) based on differences in detection probabilities between primary and secondary occasions, as well as estimation of apparent survival rates that are robust to error associated with temporary emigration (Kendal and Nichols 1995, Kendal et al. 1997). We have used these two analyses to support 3 independent studies that focus on: (1) the influence of climatic processes and habitat disturbance on sage-grouse population dynamics; (2) the influence of male breeding propensity on trends derived from lek counts; and (3) the effect of radio-collars on male survival and behavior.

General modeling approach – All demographic analyses were conducted in a general linear modeling framework, and we used an information theoretic approach to model selection (Burnham and Anderson 2002). We evaluated support for explanatory covariates based on their inclusion in competitive models (ΔAIC <3.0), and their β coefficients and associated estimates of variance. All covariates were z-standardized (mean = 0.0, standard deviation = 1.0).

Female analyses - From our female radio-telemetry data, we conducted a known-fate survival analysis to estimate monthly and annual survival of radio collared hens. A known fate analysis estimates period survival from animals whose fates are known for each sampling interval (as opposed to band recoveries where status is not known unless the animal is recovered during an interval). In addition to the known fate analysis, we used our female telemetry data to conduct a multistate analysis, which estimates the probability of transitioning to a defined state based on previous status and explanatory covariates. We used the multistate approach to evaluate determinants of female breeding success and assess heterogeneity in individual quality. We used our nest monitoring data to estimate daily nest survival probabilities and evaluate the influence of ecological covariates on nest success. Using weekly counts of chicks associated with our radio-collared hens, we conducted a Lukac's young survival model to quantify survival rates of chicks from hatch to 45 days. The Lukac's models estimate period survival rates based on repeated counts of young present with marked adults, where detection probability is explicitly incorporated using variation in counts through time.

Climate and disturbance influence on sage-grouse population dynamics - Sage-grouse are adapted to persist in arid environments despite dynamic climatic processes (e.g., drought) that lead to large annual variation in resource availability. We were interested in understanding how sage-grouse vital rates respond to stochastic variation in resources, what the net effect on population growth was, and how habitat disturbance at the landscape scale altered the relationship between resource availability and population processes. To characterize annual variation in resource availability, we estimated annual normalized difference vegetation indices

(NDVI) for our study area using Landsat 4-5 satellite imagery obtained from the Unites States Geological Survey Earth Explorer data viewer (http://edcsns17.cr.usgs.gov/NewEarthExplorer). NDVI provides an index to landscape greenness that is highly correlated with green-leaf area and is commonly used as a surrogate estimate of net primary productivity (Box et al. 1989, Paruelo and Lauenroth 1995). We applied annual NDVI values as group covariates in MARK analyses of male f (Pradel Models) and Φ (Robust Design), and tested for the overall effect of resource availability to population growth using a regression where annual λ (Pradel Models) was modeled as a function of NDVI. To evaluate how habitat loss might alter the relationship between resource availability and population dynamics, we also tested for an effect of wildfire and conversion to exotic grassland on Φ and f. Here, we quantified the cumulative footprint of wildfires within 5 km of each lek, and applied this value as a lek-level group covariate (Fig 3). We modeled exotic grassland impacts as an additive effect, as well as an interactive effect with NDVI. The later structure allowed us to assess whether the males breeding at leks impacted by fire experienced different population dynamics in response to variable resources compared to males the breed at non-impacted leks. A manuscript describing this analysis is currently in review at the journal Ecosphere.

Impacts of radio-collars on males - During our normal spring trapping activities, we marked a subset of male sage-grouse with 22 gram radio-collars in addition to the unique metal and plastic tarsal bands. We used our spring male capture, recapture, and resight data in a robust design framework to estimate differences in detection probability, lek attendance, or survival between males with and without radio-collars. Temporal variation in model structure was similar to previous robust design analyses, and we modeled annual survival (Φ) as a function of NDVI, temporary emigration (γ) as a function of male density, and allowed full time variation in encounter and recapture probabilities. Each of the 9 primary occasions (year) was broken up into 3 secondary occasions (3-4 week intervals) which were selected to split the amount physical resights and recaptures relatively evenly amongst the secondary occasions across all years. True detection probability (P*) was calculated annually from the apparent detection probability estimates (P_1-P_3) for each of the secondary occasions for the corresponding year. The radio covariate was modeled as a time-varying covariate, which allowed new and previously marked individuals to enter the radio-collar cohort upon capture if equipped with a radio-collar. We applied the radio covariate to various combinations of the survival, immigration, detection, and recapture parameters to evaluate any potential relationships between individual parameters and wearing a radio-collar.

The influence of breeding propensity on lek count trend estimate **–** Lek counts are used universally to track changing abundance of sage-grouse populations, and in some cases are used to infer changes in male abundance from one year to the next (annual population growth). One previously untested assumption is whether variation in male breeding propensity (the proportion of males that attempt to breed in a given year) may introduce sampling error into lek count trends. For each year of the study we estimated annual rates of male breeding propensity (1-γ) using robust design models, apparent annual population growth using our lek counts (λ_A), and realized λ (λ_R) using Pradel models. We then used a linear regression to partition the variance in λ_A that was associated with realized rate of growth (λ_R), breeding propensity, and unexplained error. Additionally, we assessed sources of variation in breeding propensity (Age, average male body condition, male density, NDVI, and exotic grassland impacts) to determine if we could identify any general explanations for temporal variation in breeding propensity. Finally, we compared long-term estimates of population growth from lek counts and Pradel models to evaluate the utility of lek counts for quantifying long-term population trends. A manuscript describing this analysis in greater detail is currently in review at the journal Ecological Applications.

***Female survival and costs of reproduction* –** We conducted a know-fate survival analysis to evaluate temporal variation in female monthly survival rates, to evaluate reproductive costs to survival, and to test for other ecological effects which may influence temporal variation or reproductive costs. We summarized telemetry data into monthly (i.e., the calendar month) encounter histories for each individual. Because monthly telemetry records were incomplete during the winter for some study years, we aggregated November through February telemetry records into a single 4-month interval, and estimated monthly survival during this period as $\Phi_W^{1/4}$. We used individual and group covariate effects to test hypotheses regarding the cost of reproductive activities on subsequent survival, while controlling for potential confounding factors associated with individual age and environmental conditions. We began by evaluating temporal variation in survival by modeling the effects of year, month, and season (where monthly survivals were aggregated based on biologically meaningful time intervals; Breeding = March-May, Summer = June-July; Fall = August – October; Winter = November-February). Using the best supported temporal structure, we then considered the influence of reproductive success as direct effects (effect is applied to the time period immediately following nesting or brooding) and carry-over effects (effect is applied to a later time period). We tested for 2 general forms of reproductive costs; costs associated with successfully hatching a nest, and cost associated with successfully raising a brood. Finally, we considered additional effects of hen age and annual variation in resource variability (indexed by NDVI). We assigned hens a minimum age based on their known age at capture (Chick = 0; subadult = 1; adult = 2), which increased by one for each year they remained part of the study and incorporated as a time-varying covariate into the analysis. NDVI was applied as a group covariate, and we tested for different seasonal effects of resource availability using models where NDVI effects were applied to specific combinations of seasonal intervals (e.g., the effect of NDVI was different for breeding vs. summer intervals). Where appropriate, we considered interactive effects between covariates (e.g., an interaction between female success and age). We constructed this analysis using telemetry data from March 2003 through February 2011, so as to include 8 complete study years.

***Female breeding success and reproductive heterogeneity* –** Understanding heterogeneity among individuals has recently become a prominent topic in animal ecology. In the case of sage-grouse, reproductive heterogeneity may be an especially important topic, because if there is substantial heterogeneity recruitment (and as a consequence population growth) may be driven by a small subset of high-quality females. We conducted a multi-state analysis where we assigned individuals into successful or unsuccessful breeding states for each year of the study, and estimated the probability of hen success in a given year as a function of previous reproductive status, and other ecological covariates. Hens were considered successful if they hatched a nest and raised ≥ 1 chick to 45 days of age, and were considered unsuccessful if they either 1) were not found on a nest; 2) failed all nesting attempts; or 3) nested successfully but lost their entire brood prior to 45 days. We modeled the annual probability of transition to the successful state (Ψ; analogous to annual probability of success) as a function of previous reproductive state, minimum hen age, and NDVI. For the NDVI covariate, we considered direct (effect of $NDVI_t$ on Ψ_t) and carryover (effect of $NDVI_{t-1}$ on Ψ_t) effects. Because we did not begin monitoring broods until 2005, this analysis is restricted to females monitored from 2005-2010.

Nest survival - For 2011, we developed a revised nest survival analysis to document potential observer effects on nest survival. Because the data necessary to model observer effects were not collected in 2003-2004, we omitted nests from those years for this analysis. This analysis includes 343 nests initiated from 2005-2011, of which 107 were successful. We modeled daily nest survival rate as a function of different combinations of disturbance, vegetation, spatial, temporal and demographic covariates. Temporal covariates included year and day, an index of annual raven abundance, population, season trapped, and Julian date of nest initiation. Demographic covariates included hen age, nest attempt, and clutch size, respectively. Nest vegetation covariates included percent cover within nest meter^2, average forb height within nest meter^2, average grass height within nest meter^2, average forb height within Daubenmire plots, average grass height within Daubenmire plots, percent shrub cover on the 10m transects, percent sagebrush cover on the 10m transects, and percent non sagebrush shrub cover along 10m transects. Spatial covariates, measured as total area (ha) within 1km of the nest, included wildfire, pinyon-juniper forest, all sagebrush habitat, Wyoming sagebrush habitat, and mountain sagebrush habitat. We also included nest site elevation, distance of nest from the nearest road, and distance of nest from the Falcon-Gondor power line as spatial covariates. Finally, we modeled both a nest visitation and nest flushing time-varying covariate to estimate visitor impacts on nest survival. Vegetative spatial covariates were generated from the Southwest Regional GAP database, The NDOW wildfire data layer, a roads data layer, and a data layer that delineated Falcon-Gondor. Covariates new to this year's analysis included the index of raven densities, and whether a nest was visited or flushed on a given day.

We used a systematic procedure for building competing models of daily nest survival across covariate types and spatial scales. First, we ran a series of basic models that only considered variation in time structure, and the most competitive of these models was used as the basis for subsequent models. Single covariates were then added to the best time model, and variables with meaningful betas were retained and further combined into more complex models. Interactions between individual covariates were then included and retained if model fitness was improved. After all other model structures were considered, we included visitation and flushed from nest covariates to evaluate the potential impact of observers on nest survival.

Chick survival to 45 days - Lukacs young survival models expand on the standard Cormack-Jolly Seber (CJS) approach by allowing the inclusion of a family size parameter in addition to detection probability and apparent survival parameters. This model design allows us to estimate chick survival using brood count data instead of physical recaptures of marked individuals which is required in normal CJS analyses. We used flush count data collected from 2005-2011 to estimate chick survival from hatch until approximately 45 days. We allowed annual time variation in model selection with constraints on weekly survival. Due to data limitations, the survival parameters for the first 2 weeks and last 4 weeks were constrained together. We modeled full weekly time variation in the detection probabilities with a year constraint grouping 2005-2008 and years 2009-2011 together. This constraint was modeled due a priori knowledge of a change in brood monitoring protocol instituted in 2008 that increased chick detection.

RESULTS

Field Results

Banding - During spring trapping we have banded a total of 1023 sage grouse (824 males and 199 females) over nine years of the project (Table 1). During fall trapping, we have banded 264 sage-grouse (155 females, 96 males, and 13 unknown gender chicks) over 7 years. We banded 16 sage-grouse during the 2011 fall trap (12 females and 4 males). With multiple captures of the same individual within the same year included, we have captured a total of 1674 sage grouse over 9 years of this study.

Lek Observations - We conducted 108 total lek observations during the 2011 breeding season. The total number of males observed across all leks continued to show signs of stabilization (Table 2). We observed increased male attendance on 6 leks (Modarelli, Lone Mountain, Kobeh, Gable Canyon), 1 lek no change (Horse Creek) and decreased male attendance on 4 leks (Dome House, Big Pole, Buckhorn, Quartz Road). We discovered either a new lek or movement of the Pony Express lek this year which had a high count of 11 males. We observed no males strutting on Camp lek for the second straight year. The maximum number of females observed attending leks increased substantially between 2010 and 2011 due to one morning's observation of 18 females on Quartz Road lek in 2011 (Table 2). In 2011, we generated 107 total resights of 42 unique individuals, 3 of which were from trail cameras places on leks. Total resights of color-banded individuals by year are summarized in Table 1.

Raptor Surveys - In the first 9 years of the study we conducted 199 raptor surveys for a total of 1529 points. The average number per point for each of the most common raptor species has remained relatively stable over the past nine years, however the average number per point Red-tailed hawks (*Buteo jamaicensis)*, the most abundant raptor seen, increased threefold between 2010-2011 (Table 3). The average numbers of common ravens seen per point increased dramatically between 2003 and 2007, declined drastically during 2008 to the second lowest level since the project was initiated, and have again increased over the past 3 years to near 2007 levels (Fig 4). A similar, but less pronounced, pattern in common ravens sightings at sage grouse leks has been observed (Fig. 5). Additionally, sage-grouse reactions to raven presence were less apparent in 2011 than in previous years.

Brood/Chick Monitoring - We captured and marked 120, 122, and 110 unique individual chicks from 2009-2011, respectively, and recaptured 14, 26, and 27 of them at approximately 28 days of age. Additionally, we recaptured 19 at approximately 45 days and 7 at approximately 80 days in 2011. Over the past 4 seasons, we have had some success capturing and radio-collaring chicks during the late summer that were marked as day-olds (2008 = 3; 2009 = 2; 2010 = 2; 2011=8). Of these, 4 died between fall and the following spring. One female chick hatched near the Buckhorn Mine in 2009 was monitored through the nesting season in 2010, and unsuccessfully nested in Horse Creek Valley ~ 7.4 km SE of her natal nest. A male chick hatched in the Buckhorn Mine area in 2009 survived through fall 2010, and remained in the Buckhorn Mine area when his signal was last heard. One female chick hatched in 2010 at the north end of the Simpson Park Mountains currently has an active radio and unsuccessfully nested within 1 km of her natal site in 2011. A male marked as a day-old chick in the Buckhorn Mine area was shot and recovered by a hunter in the fall of 2010 in the Cortez Mountains above the Buckhorn Mine. A male marked as a day-old chick in 2009 in the Cortez Mountains west of Cottonwood Canyon was recaptured and radio-collared as an adult in the spring of 2011 and died in late fall of 2011. A female marked as a day-old chick in the summer of 2010 in the Roberts was recaptured with her mother during the late summer of 2011 while associated mother's current brood. In the summer of 2011, 6 female chicks from radio-marked hens were captured and equipped with radio-collars and as of December 2011, 5 are still alive. The female chick that died was originally captured near the nest, captured again 80 days later ~13km from her nest site, and then moved back towards her natal area where her collar was recovered ~4 months later within 1km from her nest site.

***Radio Telemetry & Known Fate* -** A total of 199 females and 61 males have been radio collared during spring in the 9 years of the study. During the fall (in collaboration with NDOW) we have radio collared 140 females of which 83 have been adult birds (>1 year old) and 76 have been young of the year (YOY) hens. We have also radioed 16 YOY males during the fall. The number of females monitored per year and breeding rates are summarized in Table 4.

Quantitative Analyses

***Climate and disturbance influence on sage-grouse population dynamics* -** The greatest cumulative support was for models of survival and recruitment that included additive effects of NDVI and exotic grassland, as well as an interaction between the two variables (Table 5). The only recruitment model receiving support showed annual variation in NDVI corresponded closely with temporal variation in recruitment (Fig 6). NDVI covariate values had a strong positive effect on recruitment ($\beta = 0.78$; 95% CI = 0.37 to 1.19), and we observed over a 9-fold increase in per-capita recruitment (defined as recruits in year *t* per returning individual that was present in year *t-1*) following the year of highest NDVI ($f = 0.77 \pm 0.18$ SE) compared to the year of lowest NDVI ($f = 0.08 \pm 0.03$ SE). Lek-level recruitment was negatively correlated with the extent of exotic grassland surrounding the lek, and the interaction between exotic grassland and NDVI received stronger support ($\beta = -0.62$; 95% CI = -0.82 to -0.41) than an additive effect of exotic grassland alone ($\beta = -0.02$; 95% CI = -0.19 to 0.16). The interaction effect showed that leks impacted by exotic grasslands did not experience high rates of recruitment, even during years of high resource availability, but instead had low and stable recruitment of males throughout the study (Fig 7). In contrast, in the year of highest NDVI, leks that were not impacted by exotic grasslands experienced levels of recruitment nearly 70% greater than the population average ($f = 1.30 \pm 0.26$ SE).

Robust design survival models also indicated a positive influence of NDVI on survival (Fig. 6), however, 95% confidence intervals of parameter coefficients overlapped 0.0 ($\beta = 0.28$; 95% CI = -0.07 to 0.62), and the effect did not produce a comparable level of annual variation in Φ as for *f* (Table 6). We found a general negative impact of exotic grasslands on lek-level survival ($\beta = -0.29$; 95% CI = -0.55 to -0.03) that again interacted with NDVI. The interaction effect did not, however, differ significantly from 0.0 ($\beta = 0.21$; 95% CI = -0.50 to 0.08). We thus observed strong support for an interaction effect between NDVI and exotic grassland in recruitment models, whereas support for an interaction effect between NDVI and exotic grasslands was weaker in survival models. Conversion of sagebrush to exotic grassland therefore appeared to disrupt the relationship between resource availability and recruitment, while lowering adult survival was not as directly associated with available resources (Fig 7).

A substantial amount of the overall variation in population growth was explained by annual variation in NDVI (Fig 8); the general linear model relating λ_t to $NDVI_t$ explained approximately 95 % of the variance in population growth during the course of our study ($R^2 = 0.95$, $F_6 = 88.69$, $P < 0.001$). Male abundance fluctuated widely during our study, from a high of 612 males in 2005 to a low of 172 males in 2010 (Table 7).

These results demonstrate the important relationship between climate-driven variation in food resources and sage-grouse population dynamics. To better understand how climatic processes influence annual variation in NDVI, we ran a regression comparing NDVI to annual variation in precipitation and evaporation (derived from nearby National Climatic Data Center weather stations). This regression demonstrated a strong association between NDVI and these two climate variables ($R^2 = 0.71$, $F_7 = 6.09$, $P = 0.046$), where NDVI was higher (and consequently the sage-grouse experienced greater fitness) following years of high levels of precipitation and cool springs with low rates of evaporation. This analysis also further clarifies the negative influence of exotic grassland conversion on sage-grouse vital rates, and shows these negative impacts occur primarily through a reduction in high rates of recruitment during favorable conditions. Consequently habitat restoration following wildfire should concentrate on mitigating fire effects on native plant communities known to be important to reproductive components (e.g., chick survival).

Impacts of radio-collars on males* –** Top models suggested a significant negative effect of having a radio-collar on both the encounter and recapture probabilities (**β** = -0.262 95% CI = -0.441 to -0.083) and a significant positive effect on **γ** (**β** = 0.542 CI = 0.061 to 1.024), however inclusion of an effect of radio-collar on survival did not improve model fitness and confidence intervals on radio-collar beta on survival overlapped zero (**β** = -0.101 95% CI:-0.456 – 0.254) (Table 8). Model average results indicate radio-collared male sage-grouse were less likely to attend a lek in a given year (mean ***γ = 0.702 ± 0.201 SE) or less likely to be detected on a lek (mean P* = 0.332 ± 0.153 SE) if present than banded-only males (mean ***γ*** = 0.275 ± 0.219 SE; mean P* = 0.615 ± 0.155 SE)(Fig. 9), however no support for an effect of radio-collars on male survival was found. This preliminary analysis supports that equipping males with radio-collars may substantially alter their breeding behavior by lowering either the overall probability of breeding or rates of lek attendance for males that do attempt to breed. We suggest that researchers who making inferences about male sage-grouse behavior or demographic rates that are generated from radio-collared males should viewed cautiously.

***The influence of breeding propensity on lek count trend estimates* -** Effects of male density, exotic grasslands, male age, and male condition were all included in one or more competitive Robust design model of γ. Of these, there was relatively little support for meaningful effects of male condition and age. A lag effect of male density, and landscape conversion to exotic grassland received greater support. Inclusion of exotic grassland impacts substantially improved model fit, and all competitive models contained this effect (Table 9). Parameter coefficients show a negative relationship between exotic grassland impact at leks and rates of temporary absence (β = -2.15, 95% CI = -4.18 to 0.18), suggesting breeding propensity was higher at leks impacted by wildfire. However, the large range of variance and confidence intervals that slightly overlapped 0.0 indicates uncertainty about this effect. Male density, indexed by autoregressed counts of males attending leks, was positively related to temporary emigration (and hence negatively related to breeding propensity). Inclusion of density as a linear or quadratic effect improved overall model fit (Table 9), and parameter coefficients indicated stronger support for the linear effect (β = 0.70, 95% CI = 0.19 to 1.21) compared to the quadratic effect (β = 0.39, 95% CI = -0.13 to 0.92). Model-averaged estimates of γ indicate a general decline in breeding propensity following years of high density (Fig 10).

The most competitive Pradel λ model indicated a positive relationship between NDVI and λ_R (β = 0.37, 95% CI = 0.21 to 0.54)(Table 10). Estimates of general population trajectory (i.e., increase or decline) were similar between λ_A and λ_R, however, annual estimates of λ_A only fell within 95% confidence intervals of model-averaged λ_R in 3 of 7 intervals (Fig. 11). Nevertheless, variance partitioning indicated a strong relationship between λ_A and λ_R, where 76% of the variance in lek counts reflected variation in realized population growth (semipartial R^2 = 0.76). Variation in breeding propensity explained approximately 18% of the variance in λ_A (semipartial R^2 = 0.18), indicating that 75% of the total error in lek count estimates of population growth was attributed to annual variation in male breeding propensity (based on the ratio of variance associated with breeding to total variance not associated with λ_R). Approximately 94%

of the overall variation in lek counts could be attributed to realized growth and breeding propensity (R^2 = 0.94, F_7=37.81, P =0.001). The remaining 25% of total error (6 % of the total variance in lek counts) was attributed to other sources of unidentified error. Long-term estimates of λ_A (λ_A = 0.896 ± 0.047) and λ_R (λ_R = 0.912 ± 0.051) showed substantially greater agreement than annual estimates. Confidence intervals from the two estimates widely overlapped, indicating the two long-term estimates were not significantly different from each other.

This analysis demonstrates that annual variation in lek counts should not be used to infer rate of population change from one year to the next, because in the absence of marked individuals it is impossible to disentangle true population decline from temporary absence due to low breeding propensity. For this reason, inferences from lek counts should be restricted to detecting general patterns and quantifying long-term trends. A secondary result of this analysis is that male breeding propensity was highest at leks impacted by exotic grasslands. At this point the biological mechanisms for this phenomenon are unclear, however this result has important implications for monitoring populations following disturbance, because high rates of breeding propensity among remaining individuals may partially obscure the true population-level impact of disturbance, relative to control leks.

***Female survival and costs of reproduction* –** The best modeled structure of monthly female survival (Table 11) included an effect of season (Spring, Summer, Fall, Winter), effects of successfully hatching a nest on summer survival and successfully raising a brood on fall survival, an effect of hen age, and independent effects of NDVI on spring survival, and on summer/fall survival. The model also contained an interaction between the effect of successfully raising a brood on fall survival, and age. Monthly survival was highest during the winter (November-February; Φ_W = 0.983 ± 0.003), followed by summer (June-July; Φ_S = 0.980 ± 0.006), breeding

(March-May; $\Phi_B = 0.947 \pm 0.007$), and fall (August-October; $\Phi_F = 0.922 \pm 0.009$)(Fig 12). There was a negative effect of nesting successfully on summer survival (β = -0.401; 95% CI = -0.842 to 0.041), and also a negative effect of successfully raising a brood on fall survival (β = -0.176; 95% CI = -0.400 to 0.048). The net negative effect of successfully reproducing resulted in annual survival rates for successful hens of 0.498 ± 0.057, compared to annual survival of 0.610 ± 0.026 for unsuccessful hens (Fig 12). Survival generally decreased with hen age (β = -0.090; 95% CI = -0.258 to 0.078), but this effect interacted with successfully raising a brood (β = - 0.221; 95% CI = -0.452 to 0.010), such that survival decreased with age primarily for successful females (Fig 13). Finally, we found independent and opposing effects of NDVI on seasonal survival. During the spring, survival increased in years with higher NDVI (β = 0.513; 95% CI = 0.096 to 0.930). In contrast, summer and fall survival was lower in years with higher NDVI (β = - 0.162; 95% CI = -0.380 to 0.057). The net effect, however, was a general positive association between NDVI and annual survival (Fig 14).

Evaluating reproductive costs is a cornerstone of the study of life history evolution, and our research represents the first such assessment for sage-grouse. We continue to show the spring breeding season and fall period contain the highest mortality rates for female sage-grouse, and this analysis confirms previous analyses showing much of the increased mortality during the fall can be attributed to costs associated with successfully raising a brood. Additionally, the overall positive association between annual female survival (Fig 14) and NDVI shows the same climatic processes that influence male survival also act on the female segment of the population. This analysis allows us to better understand the underlying mechanisms for this positive association, because we have demonstrated the positive effect of NDVI is primarily related to increased survival during the spring breeding season. One biologic explanation for this result may be that increased availability of high-quality food resources in "good" years (e.g., years with earlier or more rapid green-up) reduces the time females must devote to foraging, allowing them to increase the number of resources they devote to predator avoidance.

Female breeding success and reproductive heterogeneity - The best-performing multistate model (Table 12) allowed the probability of female success to vary according to previous reproductive state, and included a direct effect of NDVI on the current year's reproductive success. Females who successfully raised a brood in year *t-1* were more than twice as likely to raise a brood again in the year *t* ($\Psi_S = 0.277 \pm 0.089$) compared to females who were unsuccessful in year *t-1* ($\Psi_U = 0.094 \pm 0.025$). There was a direct positive effect of NDVI on female breeding success (β = 1.336; 95% CI = 0.142 to 2.529); years with high resource availability produced higher rates of female success for both reproductive states (Fig 15). For previously successful hens, annual probability of success ranged from 0.438 ± 0.134 in 2006, to a low of 0.141 ± 0.075 in 2008. For previously unsuccessful hens, annual probability of success ranged from 0.191 ± 0.067 in 2006, to a low of 0.047 ± 0.022 in 2008 (Fig 15). The overall probability of female success, averaged across all individuals from 2006-2010, was 0.123 ± 0.026.

The implications of this analysis are three-fold. First, the probability of reproductive success is generally very low. Second, in spite of this low overall success rate, there appears to be substantial reproductive heterogeneity within this population. Although overall success is low, females who are successful once are far more likely to be successful again than females who repeatedly fail. Because of this effect, the loss of one high-quality hen will have a substantially greater influence at the population level than the loss of one low-quality hen. Finally, the positive influence of NDVI on reproductive success reinforces the importance of environmental conditions and resource availability to sage-grouse population dynamics, and provides one potential mechanism for the positive association we have found between annual recruitment rates and NDVI in other analyses.

Nest Success - Overall model-averaged daily nest survival for the study area was 0.951 (± 0.009 SE) with an overall probability of nest success based on a 37-day nesting period of 0.152 (± 0.007 SE). The best model contained additive, positive effects of clutch size (β = 0.327, 95% CI = 0.180 to 0.474), distance from nearest road (β = 0.116, 95% CI = -0.032 to 0.264), grass height within 100 m^2 of the nest (β = 0.175, 95% CI = 0.003 to 0.323), coverage of non-sagebrush shrubs within 100 m^2 of the nest (β = 0.171, 95% CI = 0.008 to 0.334), distance from Falcon-Gondor (β = 0.157, 95% CI = -0.008 to 0.321), and nest site elevation (β = 0.116, 95% CI = -0.040 to 0.273) (Table 13)(Fig 16). In addition, we found negative effects of the season the hen was trapped (β = -0.230, 95% CI= -0.371 to -0.088), total hectares of wildfire-impacted area within a 1 km radius of the nest (β = -0.142, 95% CI = -0.302 to 0.017), and flushing a hen from a nest (β = -0.112, 95% CI = -0.230 to 0.006) (Fig 16). Finally, there were negative interactions between distance from road and wildfire (β = -0.181, 95% CI = -0.401 – 0.039) as well as road distance and distance from Falcon-Gondor (β = -0.112, 95% CI = -0.250 – 0.025)(Fig. 17).

The interaction between wildfire and road distance continued to perform well in model selection (Table 13). This interaction suggests that benefit of being further away from roads on nest survival is effectively removed in the presence of wildfire scarring, which supports our continued documentation of negative impacts of invasive grasses on sage-grouse vital rates (Fig 17). The interaction between distance from Falcon-Gondor and distance from roads on nest survival is not as intuitively clear (Fig 17). Although, one possible explanation is that the probability of nest survival increases as a nests distance from both Falcon-Gondor and roads increases, however we feel that this interaction is an artifact of various spatial factors that are confounded with distance from the Falcon-Gondor line, such as elevation and overall habitat quality.

The visitation covariate was used to detect a difference between the daily nest survival rate on days a nest was visited and on days a nest was not visited, however models considering this covariate did not perform well in model selection (Table 13), and suggested no substantial negative impact of visiting a nest and nest survival ($\beta = 0.066$, 95% CI = -0.148 – 0.279). Model results suggested a lower daily survival rate for the day following flushing a hen from a nest (0.908 ± 0.029 SE) compared to the day a hen was not flushed (0.950 ± 0.009 SE). However, there was not a substantial difference between overall nest survival probabilities from a nest that was flushed (0.152 ±0.007 SE) compared with a nest that was not flushed (0.160 ±0.006 SE) (Fig 18). Given the results from this analysis, we feel that the data gained from a more active nest monitoring protocol, i.e. better estimates of clutch size, initiation date, cause of nest failures, higher probability of chick captures, are worth the slight decrease in daily nest survival rates.

Chick Survival – Model-averaged results supported a large amount of annual variation in chick survival, with noticeable boom and bust periods (Fig 19). Additionally, top models supported a population-level interaction during the first 2 weeks survival post-hatch (Table 14). Here, chicks associated with Robert Creek Mountain had significantly lower survival (0.354 ±0.057 SE) during the first 2 weeks than chicks associated with the Cortez Mountains (0.533 ±0.056 SE) (Fig 20), which we hypothesize is related to differences in the average distance a brood must move to reach high quality brood habitat from their natal habitat between the Roberts and Cortez range. A quadratic relationship between hatch date and survival was also supported, suggesting chicks from early or late nests had a higher probability of surviving until 6 weeks than chicks hatched around the mean hatching date (Fig 21). The quadratic interaction with hatch date could potentially be explained by a density-dependent predator response. Chicks hatched from early nests may have an advantage because predators have not adjusted their foraging behavior to look for chicks. As more chicks hatch, predators start to key in on the abundant food source, lowering chick survival. However, as the season progresses, the weaker chicks have already been removed from the landscape, and overall chick survival increases again. A similar hypothesis could be made in a density-dependant resource acquisitioning framework, in which intraspecific competition for resources drives the quadratic trend.

Overall chick survival to 45 days ranged from a high of 0.485 (±0.040 SE) in 2005 to a low of 0.053 (±0.015 SE) in 2007 (Fig 19). Our best models support that chick survival has steadily increased after the period of extremely low survival in 2007. In 2011, chick survival was estimated to be 0.409 (±0.028 SE). Chick survival estimates in all years other than 2007 were comparable to other studies of chick survival (Walker 2008, Dahlgren 2009). The fluctuations in chick survival illustrate one of the challenges with monitoring sage-grouse demographic rates across short time scales. The boom-bust nature of chick survival is most likely tied to plant productivity and precipitation events during key periods of the year. Studies that are monitoring sage-grouse during a short period that consist of all wet or all dry years potentially could misinterpret their results, leading to biased estimates of chick survival. Lastly, studies that attempt to artificially inflate nest survival through predator or raven control have to consider the interactions between environmental conditions and chick survival. Inflating the probability of nest survival may have no effect on sage-grouse recruitment if the experimental phase occurs during period of low chick survival.

CONCLUSIONS

We've continued to document demographic differences between the Roberts Creek and Cortez populations; however the unexplained proportion of this effect has declined as we have continued to integrate more mechanistic components to our analyses. In particular, we have shown wildfire impacts to be important determinants of male survival and nest success, and the overall high impact of fire in the Cortez range likely contributes to lower demographic rates there. However, we have preliminary results that support the costs of reproduction on female survival are less severe in the Cortez population than in the Roberts Creek population, which also coincides with higher chick survival estimates in the Cortez range. A potential hypothesis for the discrepancies in brood rearing/survival demographic rates between the 2 populations is that the average distance a brood must move from nesting habitat to high quality brood rearing habitat is much shorter in the Cortez range than in the Roberts Creek range. The increased distance that the average Roberts Creek brood flock has to move may not only be lowering chick survival, but decreasing the fitness of a successful female, lowering the probability of her survival.

The sage-grouse population in our study area continued to appear to have stabilized based on patterns in lek attendance and male capture-recapture estimates. Increased captures of new males on our study leks in 2011 suggested that recruitment was higher into this spring than the 2 years prior. The fall trap with NDOW was moderately successful in 2011, we continued to have great success in the Cortez range but substantially fewer grouse were seen in the Roberts Creek range. Despite the lack of chicks seen in the fall trap in the Roberts, estimates of chick survival were significantly higher in 2011 than the 2 years prior. We are predicting that recruitment of this year's chick cohort will be apparent in next year's capture-recapture data.

Our male capture/recapture analysis has allowed us to quantify male demographics and better evaluate the efficacy of male-based population monitoring. Our results have major implications for the application of lek counts. We suggest that interpretation of short-term fluctuations in lek counts be discouraged, as these changes may be subject to sampling error associated with variation in male breeding propensity. Lek count use and interpretation should therefore be limited to quantifying long-term trends. Additionally, the preliminary results from our male radio-collar capture/recapture data suggest additional errors with lek counts that involve radio-collared male individuals.

Modeling observer effect on nest survival is not a novel concept (Sedinger 1990, Rotella et al. 2000, Jehle et al. 2004, Bentzen et al. 2008), however research on observer effects in nest survival of sage-grouse has not been conducted previously. Despite the lack of rigorous evidence for visitation effects, previous authors have repeatedly suggested that sage-grouse nest abandonment due to observer disturbance are substantial (Fischer *et al*. 1993, Sveum *et al*. 1998, Wik 2002, Chi 2004, Holloran *et al*. 2005, Kaiser 2006, Baxter *et al*. 2008). Critics have suggested that the lower nest survival estimates maximum likelihood approaches normally produce, compared to apparent nest survival estimates, are a result of increased abandonment due to the more aggressive monitoring methodology (Connelly *et al.* 2011). However, minimizing the observer impact during nest such as by radio triangulation, longer intervals between nest checks, or delaying when observers start looking for nests, increases the probability of missing nests completely and further inflates apparent nest survival estimates. Our results support that our current monitoring protocols, including the abandonments associated with flushing, are not significantly lowering overall nest success rates, or overly biasing our nest survival estimates.

Our new chick survival analysis framework will allow us to develop more precise estimates of chick survival using less invasive and time intensive measures. We plan to add more covariates to the analysis over the next year that will allow us to gauge the relative importance of food availability, movement rates, and various environmental factors on overall chick survival. Additionally, we will continue to collect novel descriptive data on the behavior of sage-grouse with known mothers. Our capture of a juvenile female with her mother's current brood, in the summer of 2011, was the first record of fledged offspring being associated with her mother's brood. Also, our records of juvenile females returning to be within a kilometer of their natal sites offer insights to sage-grouse dispersal.

One of the more interesting results of our demographic analyses has been evidence for heterogeneity in survival of females related to their reproductive status. The positive effect of hatching a nest on monthly and annual survival, and the positive effect of clutch size on nest success, suggests that high-quality females are substantially more successful than their low-quality counterparts. However, this year we have identified decreased fall survival for females that successfully raise broods, and the effect may be more pronounced for the Roberts Creek population. Thus, there may be a trade-off between individual quality and costs of reproduction, and factors that influence survival of high-quality brood hens in the fall may be of particular management concern.

We've documented a positive association between NDVI and multiple sage-grouse vital rates, including male annual survival, female monthly survival during the breeding season, per-capita recruitment of males, and female breeding success. For female sage-grouse, breeding season survival was 8% greater, and breeding success was over 400% greater, in the year of highest compared to lowest NDVI. For male sage-grouse, annual survival was 37% greater, and per-capita recruitment was more than 900% greater, in the year of highest compared to lowest NDVI. The consequences of low plant production to sage-grouse populations therefore appear to be slight reductions in adult survival and major reductions in reproductive output. The net effect of these demographic fluctuations was a strong positive relationship between NDVI and sage-grouse population growth. In our study system patterns in NDVI were driven by annual variation in precipitation and evaporation ($R^2 = 0.71$, $F_7 = 6.09$, $P = 0.046$). These results emphasize the importance of climatic processes for driving temporal dynamics of sage-grouse populations, and have provided us with new insights into how sage-grouse respond to environmental variation in the arid Great Basin.

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Table 1. Number of males captured, recaptured, and resighted during spring trapping. Number of unique individuals is shown in parentheses.

Year	**New Captures**	**Recaptures**	**Resights**	**Collared Males**
2003	146	26(20)	12(11)	7
2004	106	43(36)	41(26)	5
2005	104	55(48)	37(25)	1
2006	134	37(35)	56(35)	1
2007	113	37(30)	34(12)	4
2008	62	30(26)	91(45)	14
2009	46	50(34)	59(23)	9
2010	50	35(31)	109(33)	22
2011	63	44(30)	107(42)	23
Total	824	357(227)	546(181*)	61*

* Does not account for unique individuals monitored across study years.

Table 2. Highest single day lek attendance for each lek by sex and year.

Males

Lek	2003	2004	2005	2006	2007	2008	2009	2010	2011
Big Pole	13	16	20	19	11	21	22	25	13
Buckhorn	23	39	40	48	21	10	11	7	3
Camp	8	12	9	9	7	5	4	0	0
Dome House	15	17	28	47	22	23	12	17	9
Gable Canyon	18	21	30	23	12	19	19	7	12
Horse Creek	43	61	40	31	17	15	4	8	8
Henderson Pass						27	16	7	8
Kobeh	14	10	12	54	6	7	6	9	14
Lone Mountain	32	33	50	63	56	34	22	17	30
Modarelli Mine	11	9	23	47	17	23	16	19	28
Pinefield	36	37	49	67	34	27	22	29	30
Pony Express	14	11	15	15	10	6	8	0	11
Quartz Road				34	11	22	20	36	27
Total	**227**	**266**	**316**	**423***	**224**	**212***	**182**	**181**	**193**

Females

Lek	2003	2004	2005	2006	2007	2008	2009	2010	2011
Big Pole	2	6	2	6	0	5	0	0	4
Buckhorn	12	3	5	24	6	7	6	4	2
Camp	0	0	1	4	3	2	1	1	0
Dome House	1	5	4	5	3	8	5	1	2
Gable Canyon	3	6	2	3	1	2	2	1	1
Horse Creek	22	28	4	4	1	6	2	1	0
Henderson Pass						8	6	3	3
Kobeh	5	3	2	4	1	1	2	7	1
Lone Mountain	3	7	17	11	14	12	6	2	10
Modarelli Mine	1	8	2	2	4	9	3	3	5
Pinefield	5	7	13	18	8	8	2	3	3
Pony Express	1	1	1	6	3	1	0	0	2
Quartz Road				2	2	2	3	8	18
Total	**55**	**74**	**53**	**87***	**46**	**69***	**38**	**34**	**51**

*Does not include increase associated with the addition of new study leks

Table 3. Average number per point of the most common raptor and corvid species seen across all three transects combined, during the months of March, April, and May.

Species	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Common Raven	0.87	0.41	1.03	1.93	2.7	0.79	1.32	1.49	2.52
American Kestrel	0.1	0.17	0.1	0.19	0.03	0.14	0.21	0.08	0.1
Golden Eagle	0.12	0.05	0.02	0.07	0.14	0.03	0.07	0.08	0.05
Ferruginous Hawk	0.05	0.01	0.03	0.05	0.02	0.03	0.07	0	0.03
Red-tailed Hawk	0.05	0.02	0.04	0.06	0.02	0.08	0.1	0.06	0.18
Swainson's Hawk	0.04	0	0.01	0.03	0	0.01	0	0	0
Northern Harrier	0.03	0.01	0.04	0.03	0	0.01	0.06	0.01	0.05
Prairie Falcon	0	0	0.01	0.01	0	0.01	0.02	0	0
Rough-legged Hawk	0.01	0.01	0	0.01	0.05	0	0.05	0.01	0
Total Points Surveyed	201	329	144	159	88	185	161	152	110

Table 4. Number of radioed females and female reproductive statistics by year.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
# of Radioed Hens	15	21	32	61	71	45	66	75	67
# of Hens Nested	11	16	30	45	30	32	51	61	51
# of Hens Failed 1st	6	9	22	25	21	26	15	46	35
# of Hens Renest	1	4	8	1	1	8	17	18	9
# Hatch	5	7	12	20	10	7	20	20	18
# With Brood at 45 Days			9	11	3	5	9	10	10

Table 5. Performance of known-fate models of female sage-grouse monthly survival in Eureka County, NV.

Model[a]	Δ AICc	wi	No Param	Deviance
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_B$ + $NDVI_{SF}$	0.000	0.374	10	1271.273
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_B$	0.025	0.369	9	1273.311
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_{SF}$	4.878	0.033	9	1278.164
Φ Season + $Nest_S$ + $Brood_F$ * Age	4.975	0.031	8	1280.274
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_F$	5.287	0.027	9	1278.573
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
Φ Year	38.862	0.000	8	1314.16

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats; Brood = female associated with ≥ 1 chick at 45 days of brood age; Nest = female successfully hatched nest in year *t*; Age = minimum known age since initial capture. Season = monthly survivals constrained to be the same based on season of the year. Covariate effects were applied to specific seasons, as indicated by subscripts: B = Breeding (March-May); S=Summer (June-July); F=Fall (August-October); W=Winter (November-February).

Table 6. Combined model weights ($\sum w_i$) indicating relative support for competing model structures of apparent survival (Φ) and per-capita recruitment (*f*) of male greater sage-grouse in Eureka County, NV. Φ was estimated using robust design models, and *f* was estimated using Pradel models, in Program MARK.

Vital Rate	Parameter structure[a]	Models Considered[b]	# Models $w_i > 0.01$	$\sum w_i$
Survival	Φ (NDVI + Exotic + NDVI*Exotic)	5	4	0.60
	Φ (NDVI + Exotic)	4	4	0.21
	Φ (Exotic)	7	4	0.18
	Φ (Year + Exotic)	4	0	0.01
	Φ (Year)	4	0	0.00
	Φ (NDVI)	4	0	0.01
	Φ (.)	5	0	0.00
Recruitment	*f* (NDVI + Exotic + NDVI*Exotic)	1	1	1.00
	f (NDVI + Exotic)	1	0	0.00
	f (Year + Exotic)	1	0	0.00
	f (Exotic)	1	0	0.00
	f (NDVI)	1	0	0.00
	f (Year)	2	0	0.00
	f (.)	1	0	0.00

[a] NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats; Exotic = total impact of exotic grassland invasion within 5.0 km of study leks; Year = full time variation among study years; . = Parameter held constant across study years.

[b] Indicates the total number of models with a given structure included in the analysis. Equivalent values indicate equal consideration.

Table 7. Annual estimates of survival (Φ), per-capita recruitment (*f*), and abundance (N) of male sage-grouse in Eureka County, Nevada. All estimates were generated using male capture-mark-recapture data in Program MARK.

Year	Φ[a] (SE)	*f*[b] (SE)	N (SE)
2003	0.57 (0.03)	0.21 (0.04)	574 (62)
2004	0.64 (0.06)	0.48 (0.07)	532 (58)
2005	0.66 (0.08)	0.77 (0.18)	612 (65)
2006	0.56 (0.04)	0.19 (0.04)	603 (64)
2007	0.48 (0.06)	0.09 (0.03)	486 (55)
2008	0.48 (0.05)	0.08 (0.03)	230 (32)
2009	0.53 (0.04)	0.15 (0.04)	230 (32)
2010	-	-	172 (27)

[a] Survival of males from year *t* to year *t+1*.

[b] Per-capita recruitment of males from year *t* into the year *t+1* breeding population.

Table 8. Performance of Robust Design capture-mark-recapture modeling impacts of radio-collars on male greater sage-grouse survival or behavior in Eureka Co., NV, from 2003-2011. γ was modeled assuming random temporary emigration (γ”= γ’)(Kendal and Nichols 1995).

Model[a]	Δ AICc	wi	No Param	Deviance
{Φ(NDVI) γ(Density+Radio) Detection (Year+Secondary+Radio) Recapture (Year+Secondary+Radio+Beta)}	0	0.668	18	3609.839
{Φ(NDVI+Radio) γ(Density+Radio) Detection(Year+Secondary+Radio) Recapture(Year+Secondary+Radio+Beta)}	1.774	0.275	19	3609.558
{Φ(NDVI) γ(Density) Detection(Year+Secondary+Radio) Recapture(Year+Secondary+Radio+Beta)}	6.018	0.033	17	3617.908
{Φ(.) γ(Radio) Detection(Year+Secondary+Radio) Recapture(Year+Secondary+Radio+Beta)}	8.28	0.011	16	3622.218
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
{Φ(.) γ(.) Detection(Year) Recapture(Quadratic trend}	100.121	0	14	3718.147

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats.

Density = autoregressed counts of males observed displaying on study leks during the previous breeding season. Beta = structural parameter differentiating between probabilities of initially detecting and repeated detections of an individual. Radio = parameter differentiating between individuals with radio-collars and individuals with bands-only.

Table 9. Performance of Robust Design capture-mark-recapture models of male greater sage-grouse temporary emigration (γ) in Eureka Co., NV, from 2003-2010. Structure for survival (Φ), capture probability (p) and recapture probability (c) were held constant across models as: Φ = NDVI + Exotic + NDVI*Exotic; p = Year ; $c = p$(Year) + occasion (Blomberg et al. *in review*). γ was modeled assuming random temporary emigration (γ"= γ')(Kendal and Nichols 1995).

Model[a]	$\Delta QAIC_c$	w_i	No. Param.	QDeviance
γ (Density + Exotic)	0.00	0.19	16	1828.12
γ (Density^2 + Exotic)	0.16	0.18	17	1826.22
γ (Density + Exotic + Age)	1.23	0.10	17	1827.29
γ (Density^2 + Exotic + Age)	1.41	0.10	18	1825.40
γ (Density^2 + Exotic + Condition)	1.86	0.08	18	1825.86
γ (Density + Exotic + Condition)	1.92	0.07	17	1827.98
γ (Exotic)	3.78	0.03	15	1833.96
γ (Trajectory * NDVI + Exotic)	3.90	0.03	18	1827.90
γ (Trajectory + NDVI + Exotic)	3.95	0.03	17	1830.01
γ (Density)	4.35	0.02	15	1834.53
γ (Trajectory + Exotic)	4.66	0.02	16	1832.78
γ (Condition + Exotic)	4.91	0.02	16	1833.03
γ (Trajectory * NDVI + Exotic + Age)	5.00	0.02	19	1826.93
γ (Trajectory * NDVI + Exotic + Condition)	5.08	0.02	19	1827.01
γ (Density^2)	5.09	0.02	16	1833.21
γ (NDVI + Exotic)	5.80	0.01	16	1833.93
γ (Trajectory + Exotic + Age)	5.96	0.01	17	1832.02
γ (Condition + Exotic + Age)	6.04	0.01	17	1832.10
γ (Year + Exotic)	6.11	0.01	21	1823.89
γ (Trajectory, + Year + Exotic)	6.11	0.01	21	1823.89
γ (Density + NDVI)	6.15	0.01	16	1834.28
γ (Trajectory + Condition + Exotic)	6.37	0.01	17	1832.43
γ (Density^2 + Condition)	6.84	0.01	17	1832.91
γ (Density^2 + NDVI)	6.96	0.01	17	1833.02
γ (Year + Exotic + Age)	7.52	0.00	22	1823.22
γ (.)	8.34	0.00	14	1840.57
γ (Age)	8.64	0.00	15	1838.82
γ (Trajectory)	8.88	0.00	15	1839.06
γ (Condition)	9.49	0.00	15	1839.67
γ (Condition + Age)	11.74	0.00	17	1837.80
γ (Year)	12.16	0.00	20	1832.02
γ (Year + Age)	13.02	0.00	21	1830.80

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats. Exotic = proportion of exotic grassland invasion within 5.0 km of study leks. Trajectory = general population trajectory (increase versus decline) as indicated by field surveys. Density = autoregressed counts of males observed displaying on study leks during the previous breeding season. Condition = average body condition of all adult males captured in a given year. Age = subadult (first breeding season) or adult (second or later breeding season).

Table 10. Performance of Pradel capture-mark-recapture models of male greater sage-grouse realized population change (λ_R) in Eureka Co., NV, from 2003-2010. Structure for survival (Φ), capture probability (p) and recapture probability (c) were held constant across models as: Φ = Year; p = Year + secondary occasion; $c = p$ (Blomberg et al).

Model[a]	ΔAIC_c	w_i	No. Param.	Deviance
λ_R (NDVI)	0.00	0.79	18	5023.76
λ_R (Trend)	3.70	0.12	18	5027.46
λ_R (Trend^2)	4.65	0.08	19	5026.32
λ_R (Year)	9.96	0.01	23	5023.22
λ_R (.)	17.15	0.00	17	5043.00

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual normalized difference vegetation indices. Trend = linear trend in annual λ_R. Trend^2 = quadratic trend in annual λ_R. Year = full annual variation. . = λ_R constant across years.

Table 11. Performance of known-fate models of female sage-grouse monthly survival in Eureka County, NV.

Model[a]	Δ AICc	wi	No Param	Deviance
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_B$ + $NDVI_{SF}$	0.000	0.374	10	1271.273
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_B$	0.025	0.369	9	1273.311
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_{SF}$	4.878	0.033	9	1278.164
Φ Season + $Nest_S$ + $Brood_F$ * Age	4.975	0.031	8	1280.274
Φ Season + $Nest_S$ + $Brood_F$ * Age + $NDVI_F$	5.287	0.027	9	1278.573
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
Φ Year	38.862	0.000	8	1314.16

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats; Brood = female associated with ≥ 1 chick at 45 days of brood age; Nest = female successfully hatched nest in year *t*; Age = minimum known age since initial capture. Season = monthly survivals constrained to be the same based on season of the year. Covariate effects were applied to specific seasons, as indicated by subscripts: B = Breeding (March-May); S=Summer (June-July); F=Fall (August-October); W=Winter (November-February).

Table 12. Performance of multistate models of female sage-grouse reproductive success in Eureka County, NV. Model structures for survival and recapture probability were held constant across models as: Φ (State + Age); p (.).

Model[a]	ΔAIC_c	w_i	No. Param.	Deviance
Ψ (NDVI- Dirrect + State)	0.000	0.437	7	540.973
Ψ (NDVI - Direct * State)	2.050	0.157	8	540.916
Ψ (State)	2.964	0.099	6	546.029
Ψ (NDVI - Carry Over + State)	3.041	0.096	7	544.013
Ψ (State * Age)	4.036	0.058	8	542.903
Ψ (NDVI - Carry Over * State)	4.827	0.039	8	543.694
Ψ (State + Age)	4.921	0.037	7	545.893
Ψ (NDVI)	5.332	0.030	6	548.397
Ψ (State + Year)	6.156	0.020	10	540.769
Ψ (.)	6.302	0.019	5	551.446
Ψ (Year)	8.254	0.007	9	545.001
Ψ (State + Year)	34.106	0.000	9	570.852

[a] Model selection notation follows Burnham and Anderson (2002). Capture-mark-recapture notation follows Lebreton et al. (1992). NDVI = standardized estimates of annual Normalized Difference Vegetation Indices measured in sagebrush habitats; NDVI was modeled as either a direct (effect of $NDVI_t$ on Ψ_t) or carry over (effect of $NDVI_{t-1}$ on Ψ_t) effect. Age = minimum known age since initial capture. State = reproductive state (Success = raised ≥ 1 chick to 45 days; Fail = unsuccessful in reproduction) in year *t-1*.

Oil and Gas Development in Western North America: Effects on Sagebrush Steppe Avifauna with Particular Emphasis on Sage-grouse

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Sagebrush (*Artemisia* spp.) steppe was once a dominant feature of the landscape in western North America covering at least 243 million acres (60 million ha) (Beetle 1960, Vale 1975) in 16 states and 3 provinces. Most of this vast expanse has been altered by human activity. Estimates of complete loss of sagebrush-dominated areas exceed 50 % (Schneegas 1967, Braun et al. 1976, Braun 1998). The remaining sagebrush steppe has been markedly altered through treatments to benefit livestock grazing including livestock grazing as a treatment, fragmentation (roads, power lines and other structures, pipelines, reservoirs, fences, etc.), and degradation (Braun 1998). More recently, urban expansion as well as development of housing scattered through large tracts has impacted wildlife use of sagebrush habitats (Braun 1998).

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While the sagebrush steppe is seasonally host to a large number of avian species (Braun et al 1976, Paige and Ritter 1999), only 5 species (Gunnison and Northern sage-grouse [*Centrocercus minimus, C. urophasianus*], sage thrasher [*Oreoscoptes montanus*], sage sparrow [*Amphispiza belli*], Brewer's sparrow [*Spizella breweri*]) are truly sagebrush obligates (Braun et al. 1976). However, at the grassland or shrub steppe interfaces with sagebrush-dominated areas, other species such as Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), mountain plover (*Charadrius montanus*), and burrowing owl (*Athene cunicularia*) were locally abundant. All of these species are now known or thought to be declining in distribution and abundance.

Oil and gas developments and their attendant structures including power lines, roads, and collection stations are not recent additions to western North America with some activity dating to the late 1800's. Exploration and development activity has tended to be cyclical depending on apparent needs, extraction costs, and price (per barrel or cubic foot). In the 1970's and early 1980's, the interest was in development of oil shale. In the early and mid 1980's, the emphasis was in the Rocky Mountain Overthrust Belt. Today, interest in oil and gas development is everywhere in the West where reserves are thought to be present. Nowhere is this more apparent than in development of coal-bed methane, especially in the area near Gillette, Wyoming. Because of the interest in rapid expansion and development of oil and gas reserves, this paper examines what is known about the effects of energy exploitation on sagebrush steppe dependent avian species and what might be logically expected during and after exploration, facilities development, and extraction. Case history examples are provided from Alberta, Colorado, and

Wyoming.

What Is Known

A relatively large body of literature exists for game species such as sage-grouse (summarized by Connelly et al. 2000) and Columbian sharp-tailed grouse (reviewed by Giesen and Connelly 1993). Reasonable information is available for passerine species breeding in sagebrush steppe and it is known that presence of sagebrush (Feist 1968; Best 1972; Schroeder and Sturges 1975; Reynolds and Rich 1978; Rich 1978, 1980; Reynolds 1981; Peterson and Best 1985a, b, 1987) and patch size (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981, 1985; Wiens et al. 1987; Knick and Rotenberry 1995, Aldridge and Brigham 2002) are important for all sagebrush obligates. Relatively little is known about the effects of habitat alteration on other species such as burrowing owls and mountain plover, which seasonally occupy the interface of sagebrush steppe and grasslands. It is known that burrowing owls are negatively impacted by plowing, reseeding, and other disturbances in breeding areas (Rich 1986, Haug et al. 1993). Plowing of native habitats and reseeding with taller grasses is also negative for mountain plovers and restrictions have been placed on oil and gas exploration in key breeding areas in Colorado, Montana, and Wyoming (Knopf 1996).

Review of the available information suggests that habitat alteration that removes live sagebrush and reduces patch size is negative for all sagebrush obligates, specifically sage-grouse, sage sparrow, sage thrasher, and Brewer's sparrow. Plowing of native habitats is also negative for burrowing owls and mountain plovers. Columbian (and other subspecies) sharp-tailed grouse are less impacted as they can positively respond to some altered habitats, provided that native shrub habitats useful in winter remain available.

Thus, sharp-tailed grouse have the best potential to maintain their distribution and abundance with changes in habitat use and disturbance.

Oil and Gas Developments and Sage-grouse

Alberta

Sage-grouse were historically abundant across southeastern Alberta, occupying as much as 18,920 mi² (49,000 km^2) in the early 1900's (Aldridge 2000). However, the current distribution of sage-grouse has been reduced to ~ 1,544 mi² (4,000 km^2), less than 10% of their historic range. Sage-grouse population data exist for the currently occupied area; however, lek counts only began in 1968 and were conducted sporadically prior to the 1990's. Thus, direct comparisons and cause and effect studies are not possible, but the available data are compelling.

Records of oil and gas developments are incomplete and difficult to obtain, but the earliest records suggest that exploration for gas began as early as 1940. The oil boom of the mid 1980's resulted in intensive oil extraction activities in southern Alberta. Over this time, the number of male sage-grouse displaying at lek sites decreased from as many as 524 males prior to the oil boom, to between 200 and 300 during and afterwards (Aldridge 2000). Similar correlations were seen in the early 1990's, with a resurgence of development activity in the heart of sage-grouse habitat (Manyberries Oil Field). Number of male sage-grouse counted in Alberta fell to the lowest known level with only 70 males counted in 1994 (Aldridge 2000). Direct disturbances (development of road or well sites) within ~ 220 yds (200 m) of three different lek complexes were noted between 1983 and 1985. None of these leks has been active since the disturbance. At that same time, drilling activities occurred within view of a fourth lek complex and the two lek satellites were reduced to one smaller lek. This site has since been reclaimed, but numbers have never recovered. Two additional known lek sites were directly disturbed at some unknown time in the past; one is now a reclaimed well site and the second was seeded to tame grass (it most likely is also a reclaimed well site). Neither of these leks has been active for at least 10 years.

To date, approximately 1,500 wells have been drilled within the current range of sage-grouse in Alberta. It is estimated that 575 wells are still producing. Thus, there are approximately 8 well sites/mi^2 (one active and two inactive well sites/km^2) of sage-grouse habitat. Connecting each of these well sites is a series of roads and trails, as well as power lines and pipelines that are interlaced with compressor stations and gas camps. These structures and linear features result in direct habitat loss, and fragment remaining suitable habitat. The effect of daily vehicular traffic along these road networks can also impact breeding activities or directly reduce survival.

There are relatively few limitations placed on spacing and density of well sites in Alberta. Each company is ‘restricted’ to drilling 16 well sites per section of land, but is allowed 16 wells per zone in which they are drilling. Thus the total number of wells could potentially far exceed 16 per section. Recommendations and guidelines are made by Alberta Fish and Wildlife to reduce the impact of such intensive drilling, particularly in important sage-grouse habitats. However, there is no current legislation that commits Alberta Public Lands or the Alberta Energy Utility Board to follow these recommendations. Under the Alberta Provincial Wildlife Act, an individual cannot willfully destroy the nest or den site of an endangered species (sage-grouse are listed as endangered in Alberta and Canada). This provincial legislation offers little or no protection for sage-grouse breeding and nesting habitat and, currently, there is no federal legislation in place.

Over the last three decades, the Alberta sage-grouse population has declined by 66-92% (based on the currently occupied range only, Aldridge 2000). Currently, only seven of 31 historic lek complexes remain active. The future plans for oil and gas developments within the range of sage-grouse are unknown, but expansion is expected. The cumulative impacts of further activities could result in reduction of the Alberta sage-grouse population to non-viable levels.

Colorado

Sage-grouse historically occurred (Braun 1995) in at least eight counties in Colorado in which oil and gas development is common. No replicated, designed cause and effect studies have explored the impacts of oil and gas production on sage grouse populations although Braun (1987, 1998) generally discussed the apparent short-term impacts. Presently, active oil and gas production occurs in only four counties (Jackson, Moffat, Rio Blanco, and Routt) while sage-grouse populations within areas impacted by coal-bed methane production (LaPlata and Montezuma) or that could be potentially impacted by development of oil shale (Garfield) are no longer present due to a complexity of factors.

Oil and gas developments preceded formalized counts of sage-grouse in Colorado and date to at least the early 1920's. Counts of sage-grouse were initiated on a sporadic basis in Colorado in the late 1940's. These counts were incomplete and primarily focused on larger, more accessible leks. Thus, data collected from the 1940's to the early 1970's are not directly comparable to those collected in the last 25-30 years.

Therefore, it is not possible to be definitive about actual impacts of oil and gas development on sage-grouse.

The most complete data set for sage-grouse and oil and gas production is from North Park in Jackson County. Development of the McCallum Field was initiated in 1926 and it continues to be active with 47 producing wells, 39 water injection wells, 25 abandoned (plugged) wells, and 6 approved but not drilled wells in an area of approximately 8,600 acres (2,125 ha). This area has a well-developed unimproved road network with one paved road to a processing plant, numerous pipelines, but only a few power lines. Sage-grouse were reported to occur in the McCallum Field in the 1940's but no data are available. During the 1973-2001 interval, at least 11 leks were active within or immediately adjacent to the McCallum Field. Seven of these leks were active in 2001 with a combined total of 181 males, 12.8 % of the total males counted and 20.6 % of the active leks in North Park. Examination of each active lek site indicated that only two were within sight of an active well or power line. Most were out of sight because of topography that also made noises associated with pumping and oil field activities inaudible to the human ear when an observer was on the lek site. Only three active leks were within the main oil field and most (8 of 11 known lek sites) were on the periphery. During the 1973-2001 interval, number of male sage-grouse counted and active leks in this area fluctuated in synchrony with the entire sage-grouse population in North Park. Sage-grouse are also known to over winter within the McCallum Field (Beck 1975) because a series of ridges are wind swept of most snow.

Locations of the known active sage-grouse leks in the McCallum Field suggest selection for sites that are removed from disturbance such as active wells, the processing plant, the paved road, and power lines. The McCallum Field is a relatively small, older, moderately developed oil production area and demonstrates that sage-grouse continue to use areas in and near oil production facilities provided that suitable sagebrush-dominated habitats are available and that they have opportunity to select sites that are not disturbed by or apparent from physical structures and paved roads. Despite the fragmented (by trails, pipelines, power lines, and several roads) nature of the habitat in this area, only small areas are no longer useable by sage-grouse.

Wyoming

Oil and gas development in Wyoming dates to at least to 1883 (Salt Creek Field). Since that time, many additional oil and gas fields have been discovered and developed throughout areas occupied by sage-grouse. Presently, the focus is on development of coal-bed methane in northeastern Wyoming (and adjacent southeastern Montana).

Coal-bed methane (CBM) gas development in northeast Wyoming first began in 1987 with a test well. Over the next 10 years, more wells were drilled and markets were developed for the gas. From 1997 through 2001, nearly 12,000 CBM wells were brought into production. Another 40,000 wells are expected to be developed within the Powder River Basin over the next 10 years (BLM Draft EIS for the Powder River Basin Oil and Gas Project, January 2002). Nearly 80 % of the production to date occurs on private surface lands with the remainder on State, BLM, and USFS owned lands. Over half of the mineral ownership within the Basin is private. CBM production involves drilling relatively shallow water wells into the coal seams to pump off the water and release the gas. The gas is then sent through a series of compressor stations and finally released into large transportation pipelines for sale. Discharge water is either impounded locally or released into area drainages. Each well has at least one unimproved road, an electrical line, a gas pipeline, and a water discharge pipeline. For every 6-10 wells, there is a small single-stage compressor. Larger, two-stage compressor stations are built for every 3-5 smaller compressor stations and there is a larger facility for third stage gas compression. All facilities have improved road access, utility lines, overhead power lines, and underground pipelines. The expected production life of a CBM well is about 7-15 years depending upon the depth of the coal seam and the amount of gas present. With an estimated 25 trillion cubic feet of CBM within the Powder River Basin, the life of the development is expected to be 30-50 years.

Prior to 2001, wells were drilled on a 40-acre (16 ha) spacing. Currently, wells are drilled on an 80-acre (32 ha) spacing; however, exceptions to this rule are often granted to facilitate production. The amount of disturbance from pipelines, power lines, and roads is fairly similar with either well spacing criteria. Although the actual disturbed area from wells, compressors, pipelines, and roads is relatively small (typically 15-20 acres [6-8 ha]) per section, the overall project area is very large and mostly contiguous. Currently, the 12,000 active wells occur over an area of ~ 4,500 mi^2 (11,655 km^2). The total field development area is ~ 11,000 mi^2 (28,490 km^2), which will result in a total of over 300,000 acres (121,410 ha) in direct habitat loss. Predominate habitats within the CBM development area include sagebrush/grassland types, agricultural lands (hay and grain fields), and some mixed shrub communities. Most of the area is considered yearlong sage-grouse habitat with over 200 known active leks. Not all of the area has been extensively searched for sage-grouse so the actual number of leks is considered to be much higher.

Impacts to sage-grouse from CBM development include direct loss of habitats from all production activities along with indirect affects from new power lines and significantly higher amounts human activity, both during initial development and during production. Direct habitat loss to sage-grouse to date with nearly 12,000 wells in production includes an estimated 5,000 acres (2,024 ha). CBM activity has affected an estimated 28 % of the known sage-grouse habitats within the project area. Development will continue to affect more sage-grouse habitats over the next 30-50 years as new wells are drilled within areas that contain known sage-grouse populations and their habitats. Should all of the project area be placed into production, over 50 % of the known sage-grouse range will be either directly or indirectly affected.

Sage-grouse population responses to CBM development are just beginning to be observed as most of the current production has only occurred over the past 4 years and nearly 70 % of the current production in just the past 2 years. Although CBM production is fairly recent; there are a few early indications of detrimental affects on sage-grouse as a result of this development.

There are 200 CBM wells within 0.25 miles (0.4 km) of 30 known sage-grouse leks. For these leks, there has been significantly fewer males/lek and the rate of growth is much lower when compared to other less disturbed leks (Fig 1). Direct disturbance and loss of habitats are the suspected causes for these differences. Some 6,000 miles (9,656 km) of new overhead power lines have been constructed since CBM development began. Another 5,000 miles (8,046 km) of overhead power lines are expected as CBM development continues over the next 10 years. Currently, there are 40 known sage-grouse leks that have an overhead power line within 0.25 miles (0.40 km) of the lek. Sage-grouse numbers for these leks have a significantly lower growth rate than observed on leks that do not have an overhead power line so close to the breeding ground. Higher raptor predation rates because of perches are the expected cause. The proximity of CBM compressor stations to sage-grouse leks is also having a measurable negative impact on sage-grouse. Currently, there are nearly 200 CBM facilities within 1 mile (1.6 km) of a sage-grouse lek. Sage grouse numbers are consistently lower for these leks than they are for leks that do not have this disturbance. Direct habitat losses from the site itself, roads and traffic, and the associated noise are mostly likely the reasons behind this finding.

The cumulative impact to sage-grouse from all CBM activities is just starting to be observed (Fig. 2). Currently, nearly 90 sage-grouse leks lie within the CBM development area, or about 40 % of the known leks within northeast Wyoming. As development continues, another 50-70 leks areas will be impacted by CBM. Population monitoring will most likely reveal severe consequences to sage-grouse from this activity; however, this knowledge will most likely come too late to result in any major initiatives to protect the birds or their habitats.

Mitigation of CBM impacts on sage-grouse has been mostly minimal and usually voluntary by the operators involved because nearly 80 % of the surface ownership is private. On federal lands, companies are required to avoid lek disturbance during the spring breeding season, reduce compressor noise near leks, and to place overhead power lines at least 0.5 miles (0.8 km) from any sage-grouse breeding or nesting grounds. Companies are also required avoid sagebrush habitats when locating impoundments.

All of these requirements can be waived by the federal land management agencies. There are no mitigation requirements or stipulations for sage-grouse on private land/private mineral CBM production.

Concluding Comments

The effects of oil and gas developments on sage-grouse and other sagebrush-grassland avifauna are poorly understood because of the lack of replicated, well designed studies. However, it is clear that all sagebrush-grassland dependent birds have specific habitat requirements including shrub structure and patch size. We believe the immediate effects of development are clearly negative because of loss of habitat and disturbances associated with structures, roads, and noise, especially during the breeding season. We hypothesize that numbers of individual birds of each species decrease with initial development, and then increase to some unknown level below that prior to development. A return to pre-disturbance levels of abundance is not expected because of loss of habitat. The length of time of the expected decrease is unknown and may be species dependent, as well as dependent upon the level of activity and density of physical disturbances. Increased roads and power lines have the most potential to be negative, as does the decrease in available habitat. Increased long-term and well-funded research is needed on all bird species in areas to be developed and presently developed for oil and gas production so that a sound scientific basis becomes available. Cause and effect studies using an active adaptive management approach (Walters 1986) are necessary to fully understand the implications of energy developments on wildlife species. We believe it is the responsibility of the oil and gas industry to demonstrate their activities have no negative impacts initially, short-term, or over the long-term. We especially believe the impacts of oil and gas development have been and are negative for sage-grouse and this species, because of its' requirement for large areas of sagebrush-dominated habitats, will be placed at risk of local extirpation in intensively developed areas. Thus, we strongly recommend the published "Guidelines to manage sage grouse populations and their habitats" (Connelly et al. 2000) be followed in all areas with populations of sage-grouse. This is not presently done, as some agencies pick and choose which guidelines to follow and vary their application among states, districts, and resource areas or virtually ignore them, as is the case in both Alberta and Saskatchewan. Further, it would be desirable to have uniformity in application of habitat guidelines for all bird species among all agencies across the entire shrub-steppe region. Finally, the oil and gas industry should be expected to fully mitigate for documented decreases in useable habitat as well as in populations of specific bird species. Mitigation should also consider those impacts that can be reasonably expected including cumulative effects. Consideration should be given to removing other uses of sagebrush habitats that also have cumulative effects on specific avian species as well as other wildlife.

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Figure Captions

Figure 1. Sage-grouse response to CBM wells and drilling in Wyoming. Average males/lek for both leks within ¼ mile of a CBM Well (n = 30) and leks outside ¼ mile of a CBM well (n = 200). Note, since 1996 when CBM production started to significantly increase, sage grouse response in areas of gas production has been increasing at significantly lower rate that for those leks outside of this area.

Figure 2. Sage-grouse response to the cumulative affects of CBM development in Wyoming. There are 90 sage grouse leks that have CBM development within 2 miles of the lek. Within this area, there are 3,688 wells, 168 facilities, and 872 miles of overhead power lines. The amount of direct habitat loss and displacement can only be estimated at this time. As development continues, adverse affects on sage grouse will continue.

Fig. 1

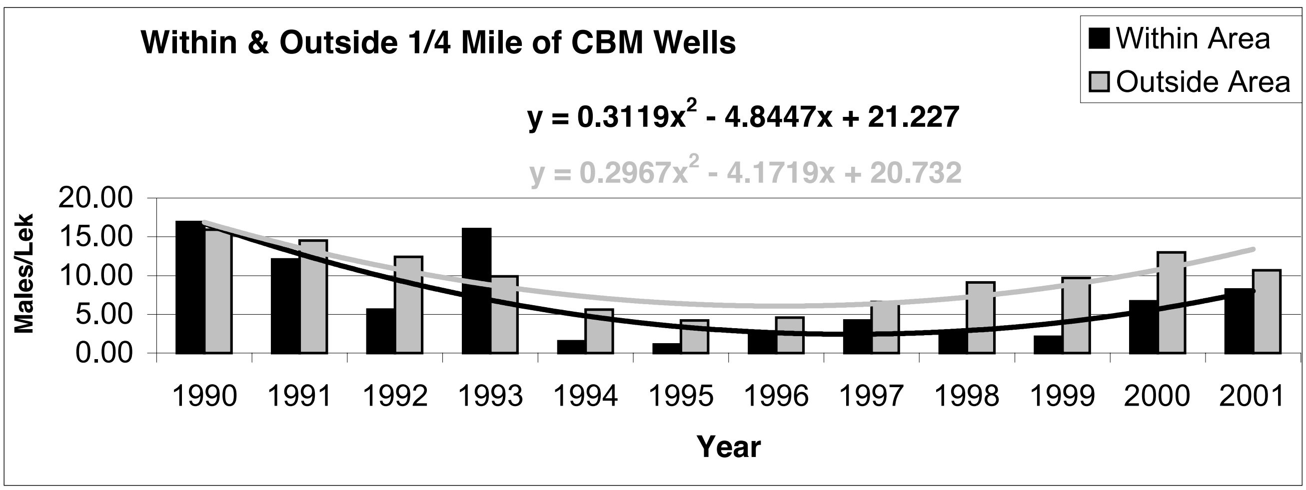
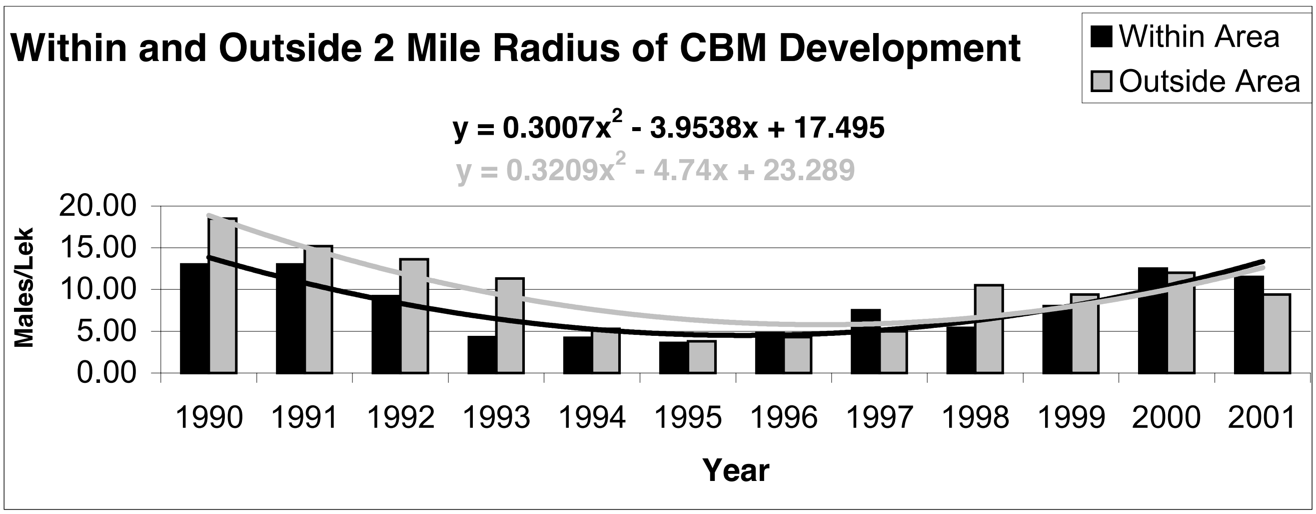

Within & Outside 1/4 Mile of CBM Wells
Within Area
Outside Area
y = 0.3119x2 - 4.8447x + 21.227
y = 0.2967x2 - 4.1719x + 20.732
Males/Lek
20.00
15.00
10.00
5.00
0.00
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year

Fig. 2


Within and Outside 2 Mile Radius of CBM Development
Within Area
Outside Area
y = 0.3007x2 - 3.9538x + 17.495
y = 0.3209x2 - 4.74x + 23.289
20.00
15.00
10.00
5.00
0.00
Males/Lek
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year

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Management and Conservation Article

Effectiveness of Raptor Perch Deterrents on an Electrical Transmission Line in Southwestern Wyoming

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ABSTRACT In sagebrush–steppe and other open habitats, power lines can provide perches for raptors and other birds in areas where few natural perches previously existed, with potential negative impacts for nearby prey species, such as greater sage-grouse (*Centrocercus urophasianus*). Between September 2006 and August 2007, we used driving surveys, behavioral-observation surveys, and prey-remains surveys to assess the ability of perch-deterrent devices to minimize raptor and common raven (*Corvus corax*) activity on a recently constructed transmission line in southwestern Wyoming. All survey methods demonstrated that activity was significantly lower on the deterrent line compared with a nearby control line; however, deterrent devices did not entirely prevent perching. Considering use of cross-arms or pole-tops alone, we sighted 42 raptors and ravens on the deterrent line and 551 on the control line during 192 driving surveys of each line. Golden eagles (*Aquila chrysaetos*) and ravens were the species most commonly observed successfully overcoming deterrent devices. Smaller rough-legged hawks (*Buteo lagopus*) regularly avoided deterrents by perching on conductors (i.e., wires). We documented much off-line activity near both survey lines and suggest that fewer birds near the deterrent line likely reflected reduced availability of nearby alternate perches. There was a pronounced winter peak in on-line perch use, with the effect more evident on the control line. Behavior surveys corroborated our driving-survey results but were otherwise unproductive. During 549 prey-remains surveys of each line, we found 9 single and 60 grouped prey items near deterrent-line poles, compared with 277 single and 467 grouped items near control-line poles. We observed few sage-grouse in the study area but did witness a likely power line–related, raptor-caused sage-grouse mortality. Overall, our results suggest that perch-deterrent devices can reduce raptor and raven activity on power-line structures, but to determine their utility on entire power-line segments, we suggest managers consider 1) what level of reduction in perch activity is worth the cost, and 2) the availability of alternate perches in the surrounding landscape.

KEY WORDS *Aquila chrysaetos*, behavior, *Centrocercus urophasianus*, golden eagle, greater sage-grouse, perch deterrents, power lines, raptors, Wyoming.

Many raptor species and common ravens (*Corvus corax*) use structures associated with electrical distribution (low voltage) and transmission (high voltage) lines (hereafter, collectively, power lines) for nesting and perching (Williams and Colson 1989, Blue 1996, Avian Power Line Interaction Committee [APLIC] 2006, Lammers and Collopy 2007). Power-line structures may be especially attractive to raptors in treeless areas, such as in open habitats characteristic of the Intermountain West and Great Plains, because of the limited availability of natural nesting and perch sites (Gilmer and Stewart 1983, APLIC 2006). Because of the potential for power lines to alter distribution and abundance of raptors and ravens in these areas, it has been suggested that power lines may have indirect negative impacts on other species within their area of influence.

In particular, power lines, via their influence on raptors, have been implicated as one of many human-caused factors contributing to declines of greater sage-grouse (*Centrocercus urophasianus*; Braun 1998, Braun et al. 2002). Within Wyoming, USA, other species of management concern associated with sagebrush (*Artemisia* spp.) that may be indirectly affected by power lines include the pygmy rabbit (*Brachylagus idahoensis*), white-tailed prairie dog (*Cynomys leucurus*), ferruginous hawk (*Buteo regalis*), burrowing owl (*Athene cunicularia*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike (*Lanius ludovicianus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*). To date, however, the ability of power-line structures to alter these and other raptor–prey relationships in ecosystems, such as sagebrush–steppe, has not been adequately studied (APLIC 2006).

Options for the near-complete exclusion of raptors from power-line structures are limited to burying lines or installing perch-deterrent devices. In the past, perch-deterrent devices primarily have been used to reduce the likelihood of raptor electrocutions by discouraging use of specific structures. Although the devices apparently are well suited to that purpose (e.g., see Harness and Garrett 1999), they have not been commonly used to completely prevent raptor use of a power line. One other recent study suggested that deterrent devices may discourage, but not completely eliminate raptor and raven perching (Lammers and Collopy 2007). Currently, the western United States contains approximately 80,000 km of transmission lines, and a recent federal assessment of proposed, major, West-wide energy corridors identified the need for increased transmission capacity during the next 20 years (U.S. Department of Energy 2007). Because mitigation techniques represent a substantial cost to utility companies, the ecological value of such exclusionary practices must be properly assessed before the merit of their widespread use can be determined.

In 2003, the Kemmerer Field Office (KFO) of the Bureau of Land Management (BLM) in Wyoming required a regional utility company to install deterrent devices on a newly constructed power line in southwestern Wyoming. The objective was to minimize potential raptor depredation

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Figure 1. Raptor perch-deterrent devices (Zena, Inc., Odenville, AL) used on cross-arms and pole-tops of H-frame power-line support structures in southwest Wyoming, USA, in 2007.

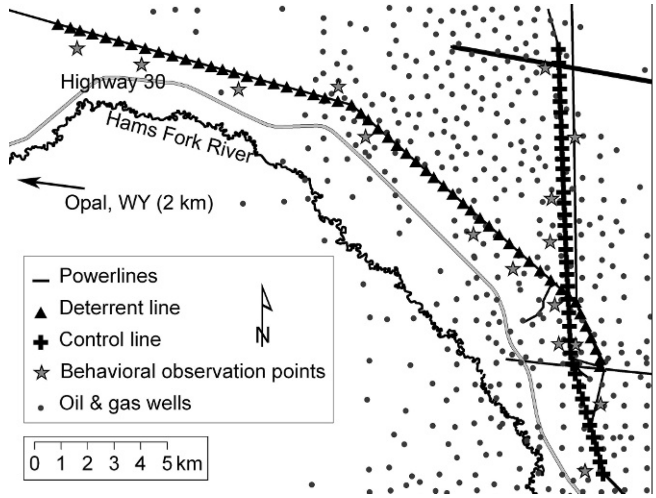

Figure 2. Arrangement of 2 power lines, with (deterrent line) and without (control line) raptor perch deterrents, surveyed in southwest Wyoming, USA, September 2006–August 2007, and nearby nonsurvey power lines, roads, and oil and gas wells.

and disturbance of greater sage-grouse and other sagebrush-obligate species. Each support structure of the power line was fitted with cross-arm spikes and pole caps (Zena, Inc., Odenville, AL; Fig. 1) at a cost of approximately $660 per support structure plus installation labor costs.

Between 15 September 2004 and 8 October 2004, the BLM KFO conducted a pilot study to evaluate the effectiveness of these deterrent devices in preventing raptor and raven perching (Oles 2007). The BLM detected no raptor or raven use of the deterrent line during 86 hours of road-survey observations. In contrast, concurrent surveys revealed 202 instances of raptor and raven perching on a nearby control line that lacked deterrents. Golden eagles (*Aquila chrysaetos*), red-tailed hawks (*Buteo jamaicensis*), and ravens accounted for >85% of all observations; other species observed using control-line structures included the prairie falcon (*Falco mexicanus*), American kestrel (*F. sparverius*), Swainson's hawk (*B. swainsoni*), and osprey (*Pandion haliaetus*). Although that pilot study appeared to demonstrate the effectiveness of installed perch deterrents, it was of short duration, occurred during one seasonal period, and was conducted when both the new power line and the deterrent devices were novel additions to this particular locale and environment.

Our goals were to augment the BLM pilot study to determine whether perch-deterrent devices continued to prevent raptor use of the new power-line structures 2 years after installation, expand the assessment through a complete annual cycle, more rigorously quantify comparative raptor use of nearby nondeterrent-equipped power-line structures, and further investigate raptor behaviors and prey interactions associated with use of these structures. To achieve these goals, our specific objectives were to assess the ability of perch-deterrent devices to exclude raptors from using power-line support structures relative to comparable, non-deterrent-equipped control-line support structures; to quantify potential seasonal changes in the effectiveness of deterrent devices and raptor use of control-line structures; to describe raptor behaviors (e.g., perching or hunting attempts) associated with deterrent devices and control-line structures; and to describe raptor prey use near deterrent and control lines.

STUDY AREA

We evaluated the same power-line segments as those in the BLM pilot study. Deterrent and control lines were located just east of Opal, Wyoming (Fig. 2) on a checkerboard of BLM-managed and private lands. The 24.9-km study section of the deterrent line ran northwest to southeast, parallel to Wyoming State Highway 30 and the Ham's Fork River. The 16.4-km study section of the control line extended north, beginning near Highway 30. Each study-line section contained exactly 107 H-frame support structures and traversed similar elevations (1,960–2,070 m), topography (rolling hills and draws), and vegetation (sagebrush and mixed desert-shrub communities). Excluding small hills and bluffs and the power poles themselves, neither line was within 1 km of potential, natural raptor or raven nest substrates (i.e., large shrubs, trees, cliffs, or rocky outcrops). Patterns of human land use, primarily natural-gas and crude-oil extraction, were also similar near both study lines, although fewer well pads were present near the western section of the deterrent line (Fig. 2). In all but 2 small sections of the deterrent line, both study lines were >1 km and >2 km from the potential influence of the highway and Ham's Fork River, respectively. Study lines were within 1 km of each other for approximately 4 km. A few perch-deterrent devices fell from the deterrent-line cross-arm sections and pole tops before we began our study.

METHODS

Surveys occurred during 4 seasonal periods: fall (Sep–Oct 2006), winter (Dec 2006–Jan 2007), spring (Mar–Apr 2007), and summer (Jun–Aug 2007). Within each seasonal period, we conducted 4 survey rounds of 4 days each. We attempted to distribute the 4 survey rounds equitably within each seasonal period, but our success was influenced by weather and road conditions. We divided each survey day into morning, midday, and evening periods, and we adjusted the specific timing of each period based on time of year. Within each daily period, we conducted 3 types of surveys: driving, behavior, and prey-remains. On any given day, different observers surveyed deterrent lines and control lines simultaneously to obviate concern over the potential confounding influence of weather on bird behavior. Daily alternation of observers assigned to each line minimized potential observer biases. Our survey design resulted in 192 driving surveys, 192 hours of behavioral-observation surveys, and 549 prey-remains surveys along both deterrent and control lines.

Surveys

We conducted driving surveys along established roads adjacent to deterrent and control lines while driving at speeds of 24−32 km/hour. When surveyors observed on-line perch use, they paused to record the time; the species and numbers of birds; the perch location (i.e., cross-arm, pole top, conductor, or cross-brace); the condition of deterrent devices, if relevant; the coordinates of the observation point; and any other pertinent comments on location or behavior. Coordinates recorded in the field reflected the observer's position on a survey road at the time of a given observation. We later translated these coordinates to on-line perch locations, based on known power-pole locations organized in a Geographic Information System (GIS) and additional field notes about specific bird locations (e.g., 2 poles S of pole closest to observer). Surveyors recorded identical information when they observed off-line behaviors within approximately 800 m of either survey line, and they added data on general behavior (e.g., perching or flying) and relevant substrates (e.g., ground or gas-well storage tank). On-line observations were the primary focus of driving surveys, with secondary emphasis placed on documenting off-line activities.

Behavioral observations occurred at preselected points adjacent to the control line (8 sites) and deterrent line (9 sites). All observation points enabled simultaneous monitoring of 7 pole structures and were 0.5 km from study lines to minimize potential observer effects on bird activity. We preselected observation points based on year-round vehicle accessibility and the survey vantage they provided. Surveyors visited each survey point 20–25 times during the study, visiting each site at least once during each 4-day survey round, and rotating visit schedules to ensure roughly equal representation of the 3 daily periods within each seasonal period. Each behavior survey lasted 1 hour, during which time, surveyors recorded all raptor and raven behaviors observed on and around a given 7-pole survey section. For each observation, surveyors recorded the time, species and numbers of birds, behavior and associated substrate, and any other relevant comments. We classified perching behaviors to specific locations in a manner similar to that discussed for on-line observations recorded during driving surveys. We attempted to classify all general behaviors in as much detail as possible, including notes on, for example, territoriality, breeding, nesting, hunting attempts, feeding, and preening. When surveyors documented hunting or feeding, they attempted to discern hunting success and prey identities with the aid of high-powered optics. As with driving surveys, we instructed surveyors to focus primarily on recording on-line activities, with nearby off-line activities recorded more opportunistically.

Immediately following each 1-hour behavior survey, surveyors searched for prey remains around the center 3 poles of the 7-pole section they had just monitored. All searches covered an area extending out 10 m in all directions from each selected power-line support structure (i.e., poles and cross-arms). When they found prey remains, surveyors recorded location coordinates for the power-line structure, distance of the remains from the structure, identity of the remains in as much detail as possible, and a brief description of the condition of the remains (i.e., size, intactness, and freshness). While walking under the lines between the 3 survey poles, surveyors also opportunistically recorded any other prey remains found. Surveyors removed remains from the 10-m-radius areas around each surveyed pole and from under the lines to prevent repeat counting on return visits.

Study-Area Characterization Using a GIS

We used ArcMap 9.2 and 2006 aerial photographs with 1-m resolution, obtained from the United States Department of Agriculture's National Agriculture Imagery Program, to digitize all power lines, gas wells, other potential perches, and improved roads visible at the 1:20,000 scale. We obtained from the BLM KFO a 25-m-resolution vegetation map created for the Moxa Arch area of Wyoming and a 10-m-resolution digital-elevation model to describe vegetation coverages and elevation variability in the study area, respectively. From these, we derived 10 variables to describe landscape and vegetation characteristics within 800 m of the 2 survey lines, and for each individual survey pole, we derived 1) distance to the nearest alternative perch, 2) the number of nonsurvey-line power poles, 3) the number of gas wells, 4) the length of roads, 5) the coverage of playa–barren habitat, 6) the coverage of saltbush (*Atriplex* spp.)–playa, 7) the coverage of greasewood (*Sarcobatus vermiculatus*)–mixed shrub, 8) the coverage of low-density sagebrush, 9) the coverage of high-density sagebrush, and 10) elevation variability.

We defined distance to the nearest alternative perch as the distance from the focal point to the next nearest non-deterrent pole, gas well, tower, or other suitable structure, excluding perches on the reference survey line (e.g., we did not consider other control poles when determining average distance to alternative control-line perches, but we included them in deterrent-line calculations). We did not constrain this measure to the 800-m radius applied to all other variables. We calculated elevation variability as the standard deviation of all 10-m pixel values within 800 m of study lines or individual poles.

Analyses

To improve compatibility of analyses and results designed to compare deterrent and control lines, we filtered out all observations associated with Highway 30 (i.e., obviously flying to or from the vicinity of the road) and proximate raptor or raven nesting activities (i.e., one ferruginous hawk ground nest near the control line and 3 raven nests, one near the control line, one near both lines, and one on the deterrent line). We also distinguished between perching on primary pole structures (i.e., cross-arms or pole-tops subject to application of deterrent devices) and other pole components (i.e., conductors or cross-braces) to facilitate direct assessment of the potential efficacy of deterrent devices.

We used *t*-tests to identify significant differences ($P \leq 0.05$) among perch, landscape, and vegetation characteristics associated with each survey line. We used basic statistics to describe general patterns of on-line perch use and off-line activity documented near each study line during driving surveys. We did not perform statistical tests of off-line observations because of our secondary emphasis on these observations and their more subjective nature (i.e., unlike on-line observations, off-line observations were not associated with a fixed number of discrete locations). Because the landscape in which we obtained off-line observations was larger surrounding the deterrent line, because of wider pole spacing, we also applied an area correction to these observations.

We used general linear modeling (GLM) to assess the potential influence of survey-line type (deterrent or control), daily period (morning, midday, or evening), season (fall, winter, spring, or summer), and their first-order interactions on total on-line perch use during driving surveys. Therefore, the model included 3 main effects and 3 interaction terms. We used post hoc, univariate *t*-tests to further elucidate differences among categories of significant main effects. We also used GLM to assess relative use of survey lines after accounting for the potential influence of various environmental covariates (i.e., the 10 variables previously described and their one-way interactions with the line type main effect) using a stepwise, backward selection procedure (to remove, $P = 0.15$). Although our models included both discrete and continuous variables with various statistical distributions, the central assumption of GLM is that errors are normally distributed (McCullagh and Nelder 1989). Therefore, we visually assessed the residuals of each model to confirm normality.

We examined basic summary statistics concerning total numbers of behaviors observed on and near deterrent and control lines, as well as for perch-related observations alone (i.e., only activities specifically involving the deterrent-line or control-line cross-arms and pole tops). We used *t*-tests to evaluate differences in average numbers of behavioral observations observed per hour on each line.

We classified prey remains as single items (i.e., likely to have come from one prey individual) or grouped items (i.e., pellets and clustered bone fragments likely to contain the remains of multiple prey individuals). We removed items located during the first search of each pole from the prey remains analyses to effectively clear each pole and remove the potential influence of survey-line age. We used separate-variance *t*-tests to identify differences in average numbers of single and grouped items detected near deterrent and control poles. We conducted all statistical analyses using SYSTAT 10.0 (Systat Software, Inc., Chicago, IL).

RESULTS

Despite the close proximity of the 2 study lines, GIS analyses revealed that, compared with the control line, deterrent-line structures were 3.5 times farther from alternate perches; had 74% fewer nonsurvey-line poles, 36% fewer gas wells, and 41% fewer kilometers of road nearby; were in areas of 40% less playa–barren and 30% less saltbush–playa, but 109% more high-density sagebrush; and were in areas with 27% less elevation variability (Table 1).

During driving surveys, we recorded only 42 raptor and raven sightings on primary, intact, deterrent-line perch structures (i.e., cross-arms or pole tops), compared with 551 sightings on primary, control-line perch structures. Golden eagles and ravens accounted for 76% of deterrent-line sightings on primary, intact perch structures (Table 2). On deterrent lines, golden eagles perched only on pole tops ($n = 20$), whereas ravens perched primarily on cross-arms (11 of 12 occurrences). We observed 2 golden eagles clearly struggling to maintain their position perched on intact pole-top devices because the birds continually flapped their wings to maintain balance. We documented other failed attempts by golden eagles ($n = 5$) and red-tailed hawks ($n = 2$) to perch on intact deterrent devices. An additional 23 deterrent-line sightings occurred on pole-tops missing deterrent devices; 78% of these sightings involved golden eagles (Table 2). We documented 248 deterrent-line sightings and 11 control-line sightings on alternate perches; 98% of those sightings involved perching on conductors. Rough-legged hawks accounted for 68% of alternate-perch observations on the deterrent line, with all such birds observed perching on the thicker conductor or conductor coils located near deterrent pole tops.

We documented 1,157 off-line observations of raptors and ravens near the deterrent line and 1,102 near the control line; however, on an areal basis, we recorded 27 sightings/km^2 near the deterrent line and 39 sightings/km^2 near the control line. Most observations were of golden eagles (34% deterrent vs. 50% control), common ravens (42% deterrent vs. 27% control), ferruginous hawks (9% deterrent vs. 7% control), rough-legged hawks (3% deterrent vs. 6% control), and red-tailed hawks (6% deterrent vs. 4% control). Most birds observed off-line were perched on nearby nonsurvey lines (26% deterrent vs. 60% control), flying (47% deterrent vs. 26% control), on the ground (12% deterrent vs. 7%

Table 1. Perch, landscape, and vegetation characteristics within 800-m radii of power-line support structures, with (deterrent line) and without (control line) raptor perch deterrents ($n = 107$ structures each along 2 surveyed lines), in southwest Wyoming, USA, in 2007.

Measure	Deterrent		Control		P
	$\bar{x}$	SE	$\bar{x}$	SE	
Distance to nearest alternate perch (km)	0.7	0.08	0.2	0.01	≤0.001
Nonsurvey line poles (no.)	2.3	0.60	8.8	0.71	≤0.001
Gas wells (no.)	2.8	0.24	4.4	0.14	≤0.001
Length of road (km)	2.4	0.13	4.1	0.13	≤0.001
Playa–barren coverage (%)	2.5	0.33	4.2	0.31	≤0.001
Saltbush–playa coverage (%)	20.2	1.32	28.7	1.51	≤0.001
Greasewood–mixed shrub coverage (%)	24.6	1.20	24.3	1.00	0.865
Low-density sagebrush coverage (%)	41.0	1.53	37.2	1.90	0.118
High-density sagebrush coverage (%)	11.7	1.99	5.6	1.07	0.008
Elevation variability (SD)	5.6	0.21	7.7	0.27	≤0.001

Table 2. Sightings during 192 driving surveys of raptors and ravens perched on different types of support structures associated with 2 power lines, with (deterrent line) and without (control line) raptor perch deterrents, in southwest Wyoming, USA, September 2006–August 2007.

Species	Deterrent line			Control line	
	Primary structures[a]	Missing deterrents	Alternate perches[b]	Primary structures	Alternate perches
Common raven	12	2	36	64	4
Rough-legged hawk	1	1	169	53	0
Swainson's hawk	0	0	16	4	0
Red-tailed hawk	2	0	1	47	0
Ferruginous hawk	0	1	0	64	0
Buteo spp.	0	0	8	1	0
Golden eagle	20	18	16	268	0
Bald eagle	0	0	0	10	0
American kestrel	7	0	1	15	7
Prairie falcon	0	1	1	25	0
Total raptors	30	21	212	487	6
Total of all birds	42	23	248	551	11

[a] Cross-arms and pole tops.
[b] Conductors and cross-braces.

control), or perched on gas structures (10% deterrent vs. 7% control). Other species and the use of other perch types accounted for <5% of off-line observations recorded near either line.

Significant predictors ($R^2 = 64.7\%$) of on-line perch use during driving surveys included survey line type ($F_{1,366} = 307.8$, $P \leq 0.001$), season ($F_{3,366} = 64.1$, $P \leq 0.001$), and a survey line type × season interaction ($F_{3,366} = 51.8$, $P \leq 0.001$; Table 3). Average perch use was 13 times greater on the control line than on the deterrent line, and overall perch use was ≥43% lower in spring and ≥188% higher in winter than in other seasons (Table 3). The interaction term reflected a 1.4 times greater increase in winter perch use (relative to average use during other seasons) on the control line compared with the deterrent line (Fig. 3).

Modeling total use of deterrent and control-line structures in relation to survey line type and 10 environmental covariates (Table 1) revealed 4 significant main effects and no significant interactions ($R^2 = 59.0\%$): survey line type ($F_{1,209} = 220.9$, $P \leq 0.001$), number of gas wells ($F_{1,209} = 7.5$, $P = 0.007$), kilometers of road ($F_{1,209} = 7.0$, $P = 0.009$), and number of nonsurvey line-poles ($F_{1,209} = 6.4$, $P = 0.012$). After accounting for the influence of other covariates, use of the control line ($\bar{x} = 5.43$ observations/structure, SE = 0.227, $n = 107$) was 45 times greater than use of the deterrent line ($\bar{x} = 0.12$, SE = 0.227, $n = 107$). Modeling the other covariates revealed that use of survey-line poles increased in areas with more gas wells but fewer roads and nonsurvey line-poles.

Total behavioral sightings per hour averaged 26% fewer ($t_{311} = 2.58$, $P = 0.010$) on the deterrent line ($\bar{x} = 2.40$, SE = 0.170, $n = 192$ 1-hr observation periods) than on the control line ($\bar{x} = 3.26$, SE = 0.286, $n = 192$). Most behavioral observations near the lines involved common ravens (38% deterrent vs. 45% control) and golden eagles

Table 3. Comparison of raptor and raven on-line perch use (no. sightings/driving survey) along 2 power lines in relation to survey line type, daily period, and season in southwest Wyoming, USA, September 2006–August 2007.

Main effect	Category	n	$\bar{x}$[a]	SE
Survey line type[b]	Deterrent	192	0.22 A	0.041
	Control	192	2.87 B	0.205
Period	Morning	64	1.77 A	0.293
	Midday	64	1.45 A	0.296
	Evening	64	1.41 A	0.323
Season	Fall	96	1.15 A	0.154
	Winter	96	3.32 B	0.381
	Spring	96	0.62 C	0.107
	Summer	96	1.09 A	0.149

[a] Within each main effect, categories that do not share letters differ significantly (post hoc, univariate t-tests: $P \leq 0.05$).
[b] Deterrent = with perch deterrents installed on support structures; control = without perch deterrents.

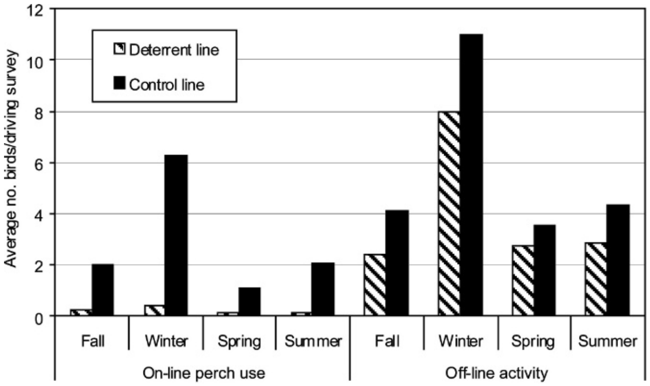

Figure 3. Seasonal distribution of raptor and raven on-line perch use and off-line activity observed along 2 power lines, with (deterrent line) and without (control line) raptor perch deterrents, in southwest Wyoming, USA, September 2006–August 2007.

(26% deterrent vs. 34% control; Table 4). Restricting the data to primary observations of study line–related perching attempts (i.e., only observations involving pole structures subject to application of perch deterrents) further magnified the difference, with 75% fewer observations per hour (t_{288} = 5.36, $P \leq 0.001$) on the deterrent line ($\bar{x}$ = 0.16, SE = 0.042, n = 192) than on the control line ($\bar{x}$ = 0.65, SE = 0.080, n = 192). American kestrels accounted for the largest proportion (48%) of perch-related observations on the deterrent line, whereas golden eagles accounted for the largest proportion (41%) of such observations on the control line (Table 4). Common ravens accounted for similar proportions of both sets of observations (23–24%). The golden eagle was the only other species that we spotted more than once using the deterrent line (19% of all deterrent-line observations), whereas most buteos (*Buteo* spp.) also frequented the control line.

Table 4. Species-specific raptor and raven behavioral observations (total sightings during 192 1-hr observation periods) recorded on or near 2 power lines, with (deterrent line) and without (control line) raptor perch deterrents, in southwest Wyoming, USA, September 2006–August 2007.

	All observations		Perch-related[a]	
Species	Deterrent	Control	Deterrent	Control
Common raven	177	284	7	30
American kestrel	27	21	15	7
Prairie falcon	4	11	1	1
Sharp-shinned hawk	2	1	0	0
Northern harrier	9	9	0	0
Buteo spp.	4	2	0	2
Rough-legged hawk	46	22	0	6
Red-tailed hawk	32	26	1	15
Swainson's hawk	5	0	0	0
Ferruginous hawk	34	36	0	12
Bald eagle	0	2	0	0
Golden eagle	118	210	6	51
Unknown raptor	2	1	1	0
Total of all birds	460	625	31	124

[a] Specific observations of perching on structures suited to application of perch deterrents (i.e., pole cross-arms and tops).

Table 5. Identities and quantities of prey remains found under 2 power lines, with (deterrent line) and without (control line) raptor perch deterrents, in southwest Wyoming, USA, September 2006–August 2007.

Type of prey remains	Deterrent	Control
Ground squirrel (*Spermophilus* spp.)	2	14
Prairie dog (*Cynomys* spp.)	0	12
Jackrabbit (*Lepus* spp.)	0	18
Pronghorn (*Antilocapra americana*)	0	2
Unidentified rabbit	3	97
Unidentified small rodent	1	9
Unidentified small mammal	1	51
Unidentified medium mammal	1	17
Unidentified large mammal	0	1
Unidentified mammal	0	35
Unidentified bird	0	4
Unidentified bone	1	17
Single items subtotal	9	277
Pellet	59	444
Bone fragments[a]	1	23
Grouped items subtotal	60	467
Total	69	744

[a] Likely old pellet remains and, hence, we counted clustered groups of bone fragments as one grouped item.

Most observations (79%) of perch-related behavior involved rather general and difficult to distinguish perching activities (i.e., resting, roosting, preening, or scanning); however, we did witness a failed attempt by a golden eagle to perch on an intact pole-top deterrent device. We also observed one American kestrel, 2 common ravens, and 3 golden eagles using deterrent-line pole tops that were missing a deterrent device. All other deterrent-line, perch-related behaviors involved successful use of cross-arms or pole tops that were fully outfitted with deterrent devices. Cross-arm spikes were the only intact deterrent devices used by American kestrels (n = 14 sightings) and common ravens (n = 5), whereas one red-tailed hawk perched on both cross-arm and pole-top devices, and one prairie falcon and 2 golden eagles used pole-top devices. The prairie falcon and one golden eagle visibly struggled to maintain their balance on the pole-top devices. We documented American kestrels (n = 3) diving from intact cross-arm spikes and a red-tailed hawk diving from a control-line cross-arm in apparent hunting attempts but without success. Finally, we observed one common raven and one ferruginous hawk feeding on unknown prey items on control-line cross-arms.

During prey-remains surveys, we found 97% fewer single prey items ($t_{582.7}$ = 12.17, $P \leq 0.001$) and 87% fewer grouped prey items ($t_{610.2}$ = 8.94, $P \leq 0.001$) per pole searched under the deterrent line (single items: $\bar{x}$ = 0.02, SE = 0.007; grouped items: $\bar{x}$ = 0.11, SE = 0.019; n = 549 pole searches) than under the control line (single items: $\bar{x}$ = 0.51, SE = 0.039; grouped items: $\bar{x}$ = 0.85, SE = 0.081; n = 549). Most (92%) identifiable single prey items were mammals of various sizes (Table 5). We positively identified only 4 single items as bird remains, all of which were likely sparrows (Emberizidae), horned larks (*Eremophila alpestris*), or other songbirds; however, we did not attempt to identify pellet contents or bone fragments. Therefore, we may have missed other avian remains within these items.

Additional Observations

One raven pair built a nest between 2 parallel rows of cross-arm spikes on the deterrent line. Construction began in early February 2007, and the nest successfully fledged 3 young in mid-July. Surveyors regularly observed adults and nestlings moving around outside the nest and using cross-arm deterrent devices and nearby conductors as perching substrates.

We documented 7 sage-grouse flushed by a golden eagle dive from a high-voltage power-line tower on 13 March 2007. The surveyor was too distant from the event to confirm the outcome of the hunting attempt, but a subsequent search of the area revealed a sage-grouse carcass. This carcass was at least a few days old but appeared to have been killed by an avian predator (i.e., feathers were plucked cleanly from the carcass and lacked the jagged rachis ends commonly associated with mammal predation). We also observed a sage-grouse flush event from near the deterrent line on 22 April 2007 in response to a golden eagle coursing low over nearby sagebrush.

DISCUSSION

We recorded 13 times as many raptors and ravens perching on primary control-line structures than on primary deterrent-line structures, and we observed every species more commonly on the control line. Our modeling results suggest that fewer gas wells, roads, and alternate pole perches near the deterrent line actually increased perching pressure and that, if all else had been equal, the differences in sighting on the control and deterrent line would have been even more exaggerated (i.e., 45 times greater activity on the deterrent line with modeling of covariates). A similar study of power lines retrofitted with deterrent devices in Nevada also revealed a significant decrease in raptor abundance and time spent perching after installation of deterrent devices (Lammers and Collopy 2007). In contrast to the pilot study conducted 2 years earlier on the same structures we studied (Oles 2007), we did not find that deterrent devices completely excluded raptors and ravens. Although we cannot discount the short duration of this prior study (i.e., 86 hr), the increased use of poles with deterrent devices that we observed may suggest that deterrent devices lose some effectiveness after their initial novelty wears off.

We most commonly observed Golden eagles and common ravens overcoming deterrent devices, but American kestrels, red-tailed hawks, and rough-legged hawks also successfully overcame the devices. Documentation of failed perching attempts by golden eagles and red-tailed hawks, as well as observations of golden eagles having noticeable difficulty balancing on pole-top devices, suggests that these larger species were unable to easily overcome deterrent devices. We also never documented a golden eagle on a cross-arm with an intact deterrent device, whereas we commonly observed ravens and American kestrels in such situations, which suggests that the spike-like devices placed on cross-arms are more effective in deterring larger species.

Our results indicate that deterrent devices substantially reduced raptor and raven use of cross-arm and pole-top perches. Moreover, most sightings on the deterrent line involved use of alternate perch locations, particularly conductors near pole tops, and most of these observations involved rough-legged hawks that migrated into the area to overwinter. This species is not likely to be much of a threat to the primary sagebrush species of concern. Rough-legged hawks are small-mammal specialists, too small to regularly take adult sage-grouse, and other species of concern are inactive and not likely to be exposed to potential predation during winter months.

General linear modeling confirmed that on-line perch use was greater on the control line and that perching activity varied among seasons along both survey lines. Specifically, perch use was greatest during winter along both lines; however, the winter spike in on-line perching was proportionately much more pronounced along the control line (Fig. 3). The lesser spike in activity along the deterrent line may reflect an influx of overwintering birds that were unfamiliar with the deterrent devices in the study area and, therefore, less likely to challenge them. Inspection of species-specific seasonal trends indicated distinct winter-activity spikes for golden eagles, common ravens, rough-legged hawks, and bald eagles (in order of abundance), but high winter abundances of golden eagles and common ravens drove the overall combined-species pattern. Golden eagle use of power poles also appeared to surge during winter in southeastern Idaho, USA (Craig and Craig 1984). In contrast to our findings, another study in southeastern Idaho revealed that common raven abundance on a power line peaked from July to September; however, that study focused on communal roosts (i.e., collections of birds) rather than on general perch use (Engel et al. 1992).

We failed to detect any influence of time of day on on-line activity patterns. Previous studies found that nocturnal use of power-line structures for roosting was significantly greater than diurnal perch use (Craig and Craig 1984, Smith 1985). Unfortunately, we were unable to conduct nocturnal surveys because of the distance of the survey lines from the survey roads.

Similar to on-line perching observations, we sighted more off-line raptors and ravens per area near the control line relative to the deterrent line, but the overall difference was much smaller (1.4 vs. 13 times greater). The difference in off-line sightings largely reflected more golden eagles and greater use of nonsurvey-line perches (commonly by golden eagles) near the control line. These results likely were related to the greater availability of nonsurvey-line perches near the control line (Table 1). If availability of alternate lines and perches had been more equitable near deterrent and control lines, we may have documented similar off-line activity near both lines. Overall, the combined on-line and off-line results suggest that availability of nondeterrent-equipped power poles, in general, accounted for much of the difference in raptor sightings on and near survey lines. Previous research suggested that power lines can either alter the abundance of raptors in an area or simply cause their redistribution (Stahlecker 1978, Ellis 1985, Steenhof et al. 1993). Our results suggest that both can occur; we observed more birds, in general, where more nondeterrent-equipped poles were available, but perching pressure was greater where fewer alternative poles existed.

Behavior surveys also revealed greater activity on and around the control line compared with the deterrent line; however, overall, these surveys proved unproductive. Lammers and Collopy (2007) suggested that future deterrent-equipped power-line studies should attempt to understand how raptor size and behavior influence the effectiveness of perch deterrents. Unfortunately, our results suggest that such an understanding may be difficult to achieve through field observations. We documented only 31 perch-related behaviors on the deterrent line during 192 survey hours, and we witnessed only 4 hunting attempts (3 by American kestrels on the deterrent line) and 2 feeding events (unknown items) during 384 total hours of observation along both lines. Most observed activity involved general perching behaviors, unhurried flights to or from a perch, and general flights through the observation area, and 1-hour survey periods often revealed no observed changes in behavior. Nevertheless, the behavior surveys did help corroborate 2 driving-survey observations, namely that golden eagles occasionally struggled to balance on pole-top deterrents and never used cross-arm spikes, whereas perching attempts by the smaller American kestrel and common raven typically involved cross-arm spikes.

Prey-remains surveys revealed roughly 31 times as many single items and 8 times as many grouped items under control-line poles as under deterrent-line poles. We cannot infer directly from these results that hunting took place from survey-line poles, only that birds fed (i.e., single items), defecated, or regurgitated (i.e., grouped items) while perched on or near the poles. As such, prey-remains surveys primarily corroborated results of driving and behavior surveys in suggesting that perching activity generally was greater along the control line.

Additional Observations

Our documentation of a successful common raven nest on the deterrent-equipped line is not surprising, considering the extreme nesting versatility of this species (Boarman and Heinrich 1999). Moreover, spike-like deterrent devices, such as those used by the nesting ravens in our study, may aid in accumulation and support of nesting material (APLIC 2006). Lammers and Collopy (2007) also documented 3 common raven nests on deterrent devices (albeit with a different design) in north-central Nevada. Note, however, that we observed no other preexisting nests or accumulated material of any type on the deterrent-equipped line during our study, and we suspect this was the first nest built on the line since its construction in 2003 (fourth nesting season in existence). In contrast, we observed 3 common raven nests on metal towers along a 1-km section of a high-voltage line near the control line, but based on observed raven activity, all 3 nests were likely associated with one pair. Regardless, it may be necessary to regularly monitor, prohibit, and remove nests of this species that are placed on artificial structures in particular areas of concern.

We recorded few observations of sage-grouse near the study lines. Unfortunately, 3 historic leks located within 3 km of the survey lines have been inactive since 2000 or earlier (T. Christiansen, Wyoming Game and Fish Department, unpublished data), precluding an assessment of potential population responses to the deterrent devices. The degree to which existing power lines, gas wells and infrastructure, or other factors may have influenced these lek abandonments is unknown. That said, recent lek trends in the Powder River Basin of northeastern Wyoming suggest a correlation between reduced lek growth rates and nearby power lines (i.e., within 0.4 km; Braun et al. 2002). Given the apparent scarcity of sage-grouse in the area, it is somewhat surprising that we did find an apparently avian-killed sage-grouse after witnessing a sage-grouse flush in response to a golden eagle diving from a metal tower near the control line. Although our evidence is corroborative at best, we stress that, to date, no other published study has confirmed any raptor taking a sage-grouse from a power-line perch. For example, Ellis (1985) reported increased golden eagle harassment of sage-grouse in northeastern Utah after installation of a power line within 200 m of a lek, but no actual kills. Again, our witnessing few hunting attempts of any kind during our behavior surveys suggests that witnessing such events may require extremely fortuitous circumstances.

MANAGEMENT IMPLICATIONS

It is unrealistic to expect any power-line deterrent device to completely prevent raptor perching in open and perch-limited habitats, such as sagebrush steppe, because birds are likely to be highly motivated to overcome deterrent devices to take advantage of these rare tall structures. Indeed, APLIC (2006) suggests that perch "discouragers" are intended to manage where perching occurs, not prevent perching entirely. Our results, as well as those of Lammers and Collopy (2007), support this general premise; however, based on this premise and on the lack of research on the impact of raptors hunting from power poles, APLIC (2006) also discourages use of perch deterrents to prevent raptors and ravens from preying on sensitive species. We suggest that a lack of research should not discourage managers from attempting to minimize potential risk associated with power lines in sagebrush ecosystems. Indeed, the greater sage-grouse management plans of numerous western states direct managers to avoid, wherever possible, construction of power lines in occupied habitat and to consider burying lines or modifying power-line structures to prevent perching (e.g., Wyoming Game and Fish Department 2003).

Perch-deterrent devices are just one potential tool available to managers attempting to manage raptor perch use, and we suggest that their value should be evaluated on a case-by-case basis. Specifically, managers must ask themselves what level of reduced perching use is worth the additional cost of installing deterrent devices (e.g., is an order of magnitude reduction in perching use of cross-arm and pole-top structures by golden eagles worth the cost?). For new construction, it will be important to consider the cost of deterrent devices relative to that of burying power lines, which achieves complete exclusion but requires greater ground disturbance. We also stress that managers need to consider the wider landscape context when evaluating the appropriateness of potential deterrent devices. We suggest that deterrent use may be most appropriate in areas with few tall perches (both natural and human-supplied) or to reduce use of specific poles (e.g., those in close proximity to a sage-grouse lek). Although birds in such areas may be more motivated to overcome deterrent devices, our results suggest that appropriately applied and maintained deterrents can still be very effective in reducing the use of poles for perching. Because power-line construction is likely to continue to expand in the West in response to increased energy needs and energy development (U.S. Department of Energy 2007), it is crucial that scientific research into their potential influence on wildlife also continues to advance and expand.

ACKNOWLEDGMENTS

This research was funded by the BLM KFO in southwest Wyoming. We thank L. Oles of the BLM for initiating a pilot study that inspired our more in-depth study and for her efforts to secure necessary funding. The senior author (S. J. Slater); other HawkWatch International staff members, A. Hutchins and M. Neal; and seasonal technicians, J. Cederstrom, A. Day, and R. Spaul, conducted the field work. This manuscript benefited from helpful reviews by L. Oles, L. LaPre, and 2 anonymous reviewers.

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Associate Editor: Bechard.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240
MAR 22 2013

Dear Interested Reader:

Last spring, I asked each state within the range of the greater sage-grouse to join the U.S. Fish and Wildlife Service (Service) in a first-of-its-kind, collaborative approach to develop range-wide conservation objectives for the sage-grouse, both to inform our upcoming 2015 decision under the Endangered Species Act and to inform the collective conservation efforts of the many partners working to conserve the species. Recognizing that state wildlife agencies have management expertise and management authority for sage-grouse, we convened a Conservation Objectives Team (COT) of state and Service representatives. I asked the team to produce a recommendation regarding the degree to which threats need to be reduced or ameliorated to conserve the greater sage-grouse so that it would no longer be in danger of extinction or likely to become in danger of extinction in the foreseeable future.

The final, peer-reviewed COT report (attached here) delineates such objectives, based upon the best scientific and commercial data available at the time of its release. I would like to clarify here the Service's interpretation of a few issues that I know are of interest to our state partners.

The highest level objective identified in the report is to minimize habitat threats to the species so as to meet the objective of the 2006 Western Association of Fish and Wildlife Agencies' (WAFWA) Greater Sage-grouse Comprehensive Conservation Strategy: reversing negative population trends and achieving a neutral or positive population trend. The Service interprets this recommendation to mean that actions and measures should be put in place now that will eventually arrest what has been a continuing declining trend. Conservation success will be achieved by removing or reducing threats to the species now, such that population trends will eventually be stable or increasing, even if numbers are not restored to historic levels. In addition, while the WAFWA Greater Sage-grouse Comprehensive Conservation Strategy overall objective is tied to ecologically delineated Management Zones for this species, the Service may measure conservation success by evaluating population trends at other appropriate scales.

One key component of this report is the identification of Priority Areas of Conservation (PACs), which were described as key habitats that are essential for sage-grouse conservation. PACs were identified using the best available information at the time of the team's completion of the report. The report acknowledges the uncertainties associated in the delineation of these areas, yet focuses our attention on these areas. These areas were identified as highly important for long term viability of the species and should be a primary focus of our collective conservation efforts. The team, however, expressed in the report that new information may come to light indicating that some areas outside the identified PACs are also highly important. This could be due to their significance for a critical life history phase, or as a link to ensure connectivity to other populations, or to retain opportunities for critical restoration efforts that may come to light in the future. If information comes to light indicating an area outside a PAC is highly important, state and federal partners working to conserve the species should consider its significance as decisions are made that could impact that area.

Therefore, the report encourages, but does not require, that important habitats outside of PACs be conserved to the extent possible. In addition, page 36 of the COT Report indicates that states with state plans developed in conjunction with the Service should follow those plans in making decisions about areas outside of PACs.

The report identifies conservation objectives and measures for each of the habitat threats assessed. For some threats, the team identified examples of actions that could be used to help attain the conservation objectives, and they termed these "conservation options." The Service interprets these "options" as suggestions and examples only, not prescriptive or mandatory actions. These options were provided by the team to stimulate discussions important in the development of conservation planning efforts that will achieve the conservation objectives in the report.

The development of this report reflects a truly collaborative federal-state effort designed to provide a clearer picture of objectives that, if met, will ensure the long-term, robust persistence of this iconic western species. Achieving these conservation objectives will require our continuing collaboration. The Service appreciates the dedication of our colleagues from the western states who joined with us to develop this report.

Sincerely,

DIRECTOR

Greater Sage-grouse
(*Centrocercus urophasianus*)
Conservation Objectives: Final Report

February 2013

PREFACE

This report delineates reasonable objectives, based upon the best scientific and commercial data available at the time of its release, for the conservation and survival of greater sage-grouse. Individual team members contributed by providing technical information and data, participating in critical discussions, providing critical reviews and edits, or authoring sections of the report. While the team tried to achieve consensus it was not always achieved. The report is provided to the Director, USFWS, at his request, to provide additional information for his use and consideration pertinent to future decision making relative to greater sage-grouse. The report will also serve as guidance to federal land management agencies, state sage-grouse teams, and others in focusing efforts to achieve effective conservation for this species.

Team members included:

- Bob Budd, State of Wyoming
- Dave Budeau, Oregon Department of Fish and Wildlife
- Dr. John Connelly, Idaho Department of Fish and Game
- Shawn Espinosa, Nevada Department of Wildlife
- Scott Gardner, California Department of Fish and Wildlife
- Dr. Kathy Griffin, Colorado Parks and Wildlife
- John Harja, State of Utah
- Rick Northrup, Montana Fish, Wildlife & Parks
- Aaron Robinson, North Dakota Game and Fish
- Dr. Michael Schroeder, Washington Department of Fish and Wildlife
- Steve Abele, U.S. Fish and Wildlife Service, Nevada
- Dr. Pat Deibert, U.S. Fish and Wildlife Service, Region 6
- Jodie Delavan, U.S. Fish & Wildlife Service, Oregon
- Paul Souza, U.S. Fish & Wildlife Service, Headquarters
- James Lindstrom, U.S. Fish & Wildlife Service, Wyoming (cartographer)

Assistance with review and editing of the document was provided by Jesse D’Elia (U.S. Fish and Wildlife Service). We also thank Don Kemner from the Idaho Department of Fish and Game for thoughtful comments.

This report is guidance only; identification of conservation objectives and measures does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. The objectives in this report are subject to modification as dictated by new findings, changes in species’ status, and the completion of conservation actions.

RECOMMENDED CITATION

U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013.

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1. BACKGROUND AND PURPOSE

On March 23, 2010, the U. S. Fish and Wildlife Service (FWS) determined that the greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) warranted the protections of the Endangered Species Act of 1973, as amended, 1531 *et seq*. (ESA), but that adding it to the List of Endangered and Threatened Wildlife under the ESA was precluded by higher priority listing actions. Species found to be warranted for listing but precluded by higher priority listing actions ("warranted but precluded") are placed on the federal list of candidate species under the ESA.[1] Shortly after the sage-grouse became a candidate species, the FWS entered into a court-approved settlement agreement with several environmental groups which formalized a schedule for making listing determinations on over 200 candidate species nationwide, including the sage-grouse and its Distinct Population Segments (DPSs). The court-approved schedule indicates that a decision on whether to proceed with listing sage-grouse, or withdrawing our warranted finding, is due by September 2015.[2]

Given the broad implications of potentially listing the sage-grouse under the ESA, in December 2011, Wyoming Governor Matt Mead and Secretary of the Interior Ken Salazar co-hosted a meeting to address coordinated conservation of the sage-grouse across its range. Ten states within the range of the sage-grouse were represented[3], as were the U.S. Forest Service (FS), the Natural Resources Conservation Service (NRCS), and the Department of the Interior (DOI) — including representatives from the DOI's Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service (FWS). The primary outcome of the meeting was the creation of a Sage-Grouse Task Force (Task Force) chaired by Governors Mead (WY) and Hickenlooper (CO) and the Director of the BLM. The Task Force was directed to develop recommendations on how to best advance a coordinated, multi-state, range-wide effort to conserve the sage-grouse, including the identification of conservation objectives to ensure the long-term viability of the species.

With the backing of the Task Force, the Director of FWS tasked staff with the development of range-wide conservation objectives for the sage-grouse to define the degree to which threats need to be reduced or ameliorated to conserve sage-grouse so that it is no longer in danger of extinction or likely to become in danger of extinction in the foreseeable future. Recognizing that state wildlife agencies have management expertise and management authority for sage-grouse, the FWS created a Conservation Objectives Team (COT) of state and FWS representatives (see Preface, above) to accomplish this task. Each member was selected by his or her state or agency. This report is the outcome of the COT's efforts.

[1] Two distinct population segments (DPSs) of sage-grouse are also on the candidate list – the Columbia Basin DPS (in Washington State) and the Bi-State population (in California and western Nevada).

[2] A decision on whether or not to proceed with listing the Bi-State population is due by September 2013. A decision on whether or not to proceed with listing the Columbia Basin DPS is due by September 2015.

[3] California, Colorado, Idaho, Montana, Nevada, Oregon, South Dakota, Utah, Washington, and Wyoming

2. SAGE-GROUSE BIOLOGY AND CURRENT STATUS

The greater sage-grouse is the largest North American grouse species and one of only two sage-grouse species in the world; the other is the Gunnison sage-grouse (*Centrocercus minimus*).

Prior to European settlement in the 19th century, sage-grouse inhabited 13 western states and three Canadian provinces, and their potential habitat covered over 1.2 million square kilometers (km^2) (0.46 million square miles (mi^2); Schroeder *et al*. 2004). Sage-grouse have declined across their range due to a variety of causes and now occupy 56 percent of their historic range (Schroeder *et al*. 2004; Figure 1). They currently occur in 11 states and two Canadian provinces (Knick and Connelly 2011). The actual decline in the number of sage-grouse from pre-settlement times is unclear as estimates of greater sage-grouse abundance were mostly anecdotal prior to the implementation of systematic surveys in the 1950s (Braun 1998).

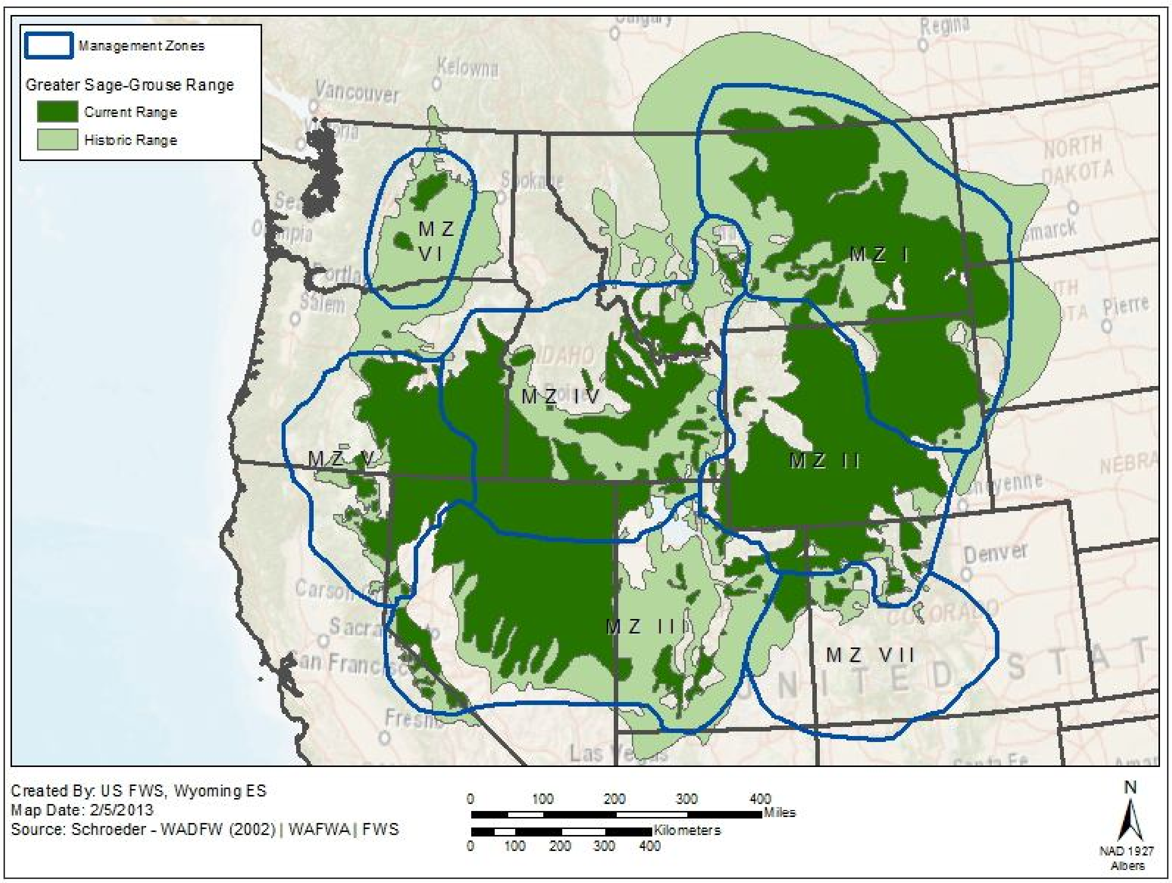

Figure 1. The current (occupied since the late 1990s) and historic (maximum distribution from the 1800s to early 1990s) range of the greater sage-grouse (Schroeder et al. 2004).

Sage-grouse depend on a variety of semiarid shrub-grassland (shrub steppe) habitats throughout their life cycle, and are considered obligate users of sagebrush (e.g., *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush), *A. t.* ssp. *vaseyana* (mountain big sagebrush), and *A. t. tridentata* (basin big sagebrush)) (Patterson 1952; Braun *et al.* 1976; Connelly *et al.* 2000;

Connelly *et al.* 2004; Miller *et al.* 2011). Sage-grouse also use other sagebrush species (which can be locally important) such as *A. arbuscula* (low sagebrush), *A. nova* (black sagebrush), *A. frigida* (fringed sagebrush), and *A. cana* (silver sagebrush) (Schroeder *et al.* 1999; Connelly *et al.* 2004). Sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats (Schroeder *et al.* 2004; Connelly *et al.* 2011b). Sage-grouse exhibit strong site fidelity (loyalty to a particular area) to seasonal habitats (i.e., breeding, nesting, brood rearing, and wintering areas) (Connelly *et al.* 2004; Connelly *et al*. 2011a). Adult sage-grouse rarely switch from these habitats once they have been selected, limiting their ability to respond to changes in their local environments (Schroeder *et al*. 1999).

During the breeding season, in spring, male sage-grouse gather together to perform courtship displays on areas called leks. Leks are typically relatively bare areas, where males perform courtship displays to attract females, surrounded by a sagebrush-grassland, which is used for escape cover, nesting, and foraging. The proximity, configuration, and abundance of nesting habitat are key factors influencing lek locations (Connelly *et al.* 1981, Connelly *et al.* 2011a).

Productive nesting areas are typically characterized by sagebrush with an understory of native grasses and forbs, with horizontal and vertical structural diversity that provides an insect prey base, herbaceous forage for pre-laying and nesting hens, and cover for the hen while she is incubating (Gregg 1991; Schroeder *et al.* 1999; Connelly *et al.* 2000; Connelly *et al.* 2004; Connelly *et al.* 2011b). Shrub canopy and grass cover provide concealment for sage-grouse nests and young and are critical for reproductive success (Barnett and Crawford 1994; Gregg *et al.* 1994; DeLong *et al.*1995; Connelly *et al.* 2004). Because average clutch sizes is 7 eggs (Connelly *et al.* 2011a), and sage-grouse exhibit limited re-nesting, there is little evidence that populations of sage-grouse produce large annual surpluses (Connelly *et al.* 2011a).

Most sage-grouse gradually move from sagebrush uplands to more mesic areas (moist areas, such as streambeds or wet meadows) during the late brood-rearing period (three weeks post-hatch) in response to summer desiccation of herbaceous vegetation in the sagebrush uplands (Connelly *et al.* 2000). Summer use areas can include sagebrush habitats as well as riparian areas, wet meadows and alfalfa fields (Schroeder *et al.* 1999). These areas provide an abundance of forbs and insects for both hens and chicks (Schroeder *et al.* 1999; Connelly *et al.* 2000). This is important because forbs and insects are essential nutritional components for chicks (Klebenow and Gray 1968; Johnson and Boyce 1991; Connelly *et al.* 2004; Thompson *et al*. 2006). Late brood-rearing habitats are often associated with sagebrush, but selection is based on the availability of forbs, correlating with a shift in the diet of chicks as they mature (Connelly *et al*. 1988, and references therein; Connelly *et al.* 2011b). As vegetation continues to desiccate through the late summer and fall, sage-grouse shift their diet entirely to sagebrush (Schroeder *et al.* 1999) and depend entirely on sagebrush throughout the winter for both food and cover (Schroeder *et al*. 1999).

Many sage-grouse move between seasonal ranges in response to habitat distribution (Connelly *et al.* 2004; Fedy *et al*. 2012). Movement can occur between winter, breeding, and summer areas; between breeding, summer and winter areas; or, not at all. Movement distances of up to 161 km (100 mi) have been recorded (Patterson 1952; Tack *et al.* 2011; Smith 2013); however, distances vary depending on the locations of seasonal habitats (Schroeder *et al.* 1999). Information regarding the distribution and characteristics of movement corridors for sage-grouse is very limited (Connelly *et al.* 2004); although, in a few areas monitoring of radio-collared birds has provided some insights into seasonal movement patterns (e.g., Smith 2013). These movement corridors are considered "traditional", as birds do not always select the most proximal habitats (Connelly *et al.* 1988; Connelly *et al*. 2011a). Sage-grouse dispersal (permanent moves to other areas) is poorly understood (Connelly *et al.* 2004) and appears to be sporadic (Dunn and Braun 1986).

Sage-grouse are dependent on large areas of contiguous sagebrush (Patterson 1952; Connelly *et al.* 2004; Connelly *et al*. 2011a; Wisdom *et al*. 2011). Large-scale disturbances (e.g., agricultural conversions) within surrounding landscapes influence sage-grouse habitat selection (Knick and Hanser 2011) and population persistence (Aldridge *et al*. 2008; Wisdom *et al*. 2011). Sagebrush is the most widespread vegetation in the intermountain lowlands of the western United States (West and Young 2000); however, sagebrush is considered one of the most imperiled ecosystems in North America due to continued degradation and lack of protection (Knick *et al.* 2003; Miller *et al*. 2011, and references therein). Not all sagebrush provides suitable habitat for sage-grouse due to fragmentation and degradation (Schroeder *et al*. 2004). Sage-grouse avoid areas where humans have caused sagebrush fragmentation, but not naturally fragmented landscapes (Leu and Hanser 2011). Very little extant sagebrush is undisturbed, with up to 50 to 60 percent having altered understories or having been lost to direct conversions (Knick *et al.* 2003).

Sagebrush is long-lived, with plants of some species surviving at least 150 years (West 1983). Sagebrush has resistance to environmental extremes, with the exception of fire and occasionally defoliating insects (e.g., webworm (*Aroga* spp.); West 1983). Most species of sagebrush are killed by fire (West 1983; Miller and Eddleman 2000; West and Young 2000), and historic fire-return intervals have been as long as 350 years, depending on sagebrush type and environmental conditions (Baker 2011). Natural sagebrush re-colonization in burned areas depends on the presence of adjacent live plants for a seed source or on the seed bank (Miller and Eddleman 2000), and requires decades for full recovery. Due to its low intrinsic resistance to fire and long recovery times, the sagebrush ecosystem is particularly susceptible to increases in fire return intervals.

There is little information available regarding minimum sagebrush patch size required to support populations of sage-grouse. This is due in part to the migratory nature of some, but not all sage-grouse populations; the lack of proximal seasonal habitats; and differences in local, regional and range-wide ecological conditions that influence the distribution of sagebrush and its associated understory. Where home ranges have been reported (Connelly *et al.* 2011a and references therein), they are extremely variable (4 to 615 km^2 (1.5 to 237.5 mi^2)). Home range occupancy is related to multiple variables associated with both local vegetation characteristics and landscape characteristics (Knick *et al.* 2003; Leu and Hanser 2011). Pyke (2011) estimated that greater than 4,000 ha (9,884 ac) was necessary for population sustainability; however, Pyke did not indicate whether this value considered groups of birds that moved long distances between seasonal habitats versus those who can meet all necessary seasonal requirements within a local area, nor if this included juxtaposition of all seasonal habitats. Large seasonal and annual movements emphasize the need for large, functional landscapes to support viable sage-grouse populations (Knick *et al.* 2003; Connelly *et al.* 2011a).

3. SUMMARY OF THREATS

The following is a brief overview of the threats to sage-grouse and sagebrush habitats. For a more complete discussion, the reader is referred to the FWS 2010 warranted but precluded finding for this species (75 FR 13910).

The loss and fragmentation of sagebrush habitats is a primary cause of the decline of sage-grouse populations (Patterson 1952; Connelly and Braun 1997; Braun 1998; Johnson and Braun 1999; Connelly *et al*. 2000; Miller and Eddleman 2000; Schroeder and Baydack 2001; Johnsgard 2002; Aldridge and Brigham 2003; Beck *et al*. 2003; Pedersen *et al*. 2003; Connelly *et al.* 2004; Schroeder *et al*. 2004; Leu and Hanser 2011; 75 FR 13910). Habitat fragmentation, largely a result of human activities, can result in reductions in lek persistence, lek attendance, population recruitment, yearling and adult annual survival, female nest site selection, nest initiation, and complete loss of leks and winter habitat (Holloran 2005; Aldridge and Boyce 2007; Walker *et al.* 2007; Doherty *et al*. 2008). Functional habitat loss also contributes to habitat fragmentation, as greater sage-grouse avoid areas due to human activities, including noise, even though sagebrush remains intact (Blickley *et al*. 2012). In an analysis of population connectivity, Knick and Hanser (2011) demonstrated that in some areas of the sage-grouse's range, populations are already isolated and at risk for extirpation due to genetic, demographic, and stochastic (i.e., unpredictable) events such as lightning caused wildfire. Habitat loss and fragmentation contribute to the population's isolation and increased risk of extirpation.

Very little sagebrush within the range of the sage-grouse remains undisturbed or unaltered from its condition prior to Euro American settlement in the 1800s (Knick *et al*. 2003, and references therein). Disturbed or altered habitats have less resilience than intact habitats. Due to the disruption of primary patterns, processes and components of sagebrush ecosystems since Euro American settlement (Knick *et al.* 2003; Miller *et al*. 2011), the large range of abiotic variation, the minimal short-lived seed banks, and the long generation time of sagebrush, restoration of disturbed areas is very difficult. Not all areas previously dominated by sagebrush can be restored because alteration of vegetation, nutrient cycles, topsoil, and living (cryptobiotic) soil crusts has exceeded recovery thresholds (Knick *et al*. 2003; Pyke 2011). Additionally, processes to restore healthy native sagebrush communities are relatively unknown (Knick *et al*. 2003). Active restoration activities are often limited by financial and logistic resources (Knick *et al*. 2003; Miller *et al.* 2011) and may require decades or centuries (Knick *et al.* 2003, and references therein). Landscape restoration efforts require a broad range of partnerships (private, state, and federal) due to landownership patterns (Knick *et al*. 2003). Except for areas where active restoration is attempted following disturbance (e.g., mining, wildfire), management efforts in sagebrush ecosystems are usually focused on maintaining the remaining sagebrush (Miller *et al.* 2011; Wisdom *et al*. 2011).

Fire is one of the primary factors linked to loss of sagebrush-steppe habitat and corresponding population declines of greater sage-grouse (Connelly and Braun 1997; Miller and Eddleman 2001). Loss of sagebrush habitat to wildfire has been increasing in the western portion of the greater sage-grouse range due to an increase in fire frequency. The increase in mean fire frequency in sagebrush ecosystems has been facilitated by the incursion of nonnative annual grasses, primarily *Bromus tectorum* (cheatgrass) and *Taeniatherum asperum* (medusahead) (Billings 1994; Miller and Eddleman 2001). The positive feedback loop between exotic annual grasses and fires can preclude the opportunity for sagebrush to become re-established. Exotic annual grasses and other invasive plants also alter habitat suitability for sage-grouse by reducing or eliminating native forbs and grasses essential for food and cover. Annual grasses and noxious perennials continue to expand their range, facilitated by ground disturbances, including wildfire (Miller and Eddleman 2001; Balch *et al.* 2013), improper grazing (Young *et al*. 1972, 1976), agriculture (Benvenuti 2007), and infrastructure associated with energy development (Bergquist *et al*. 2007). Concern with habitat loss and fragmentation due to fire and invasive plants has mostly been focused in the western portion of the species' range. However, climate change may alter the range of invasive plants, potentially expanding the importance of this threat into other areas of the species' range.

Habitat loss is occurring from the expansion of native conifers (e.g., pinyon-pine (*Pinus edulis*) and juniper (*Juniperus* spp.) [pinyon-juniper]), mainly due to changes in fire return intervals and the overstocking of domestic livestock, particularly during the latter 1800's and early 1900's (Miller and Rose 1999); however, these factors may not entirely explain the expansion of western juniper (Soulé and Knapp 1999). Conifer encroachment may be facilitated by increases in global carbon dioxide (CO_2) concentrations, and climate change, but the influence of CO_2 has not been supported by some research (Archer *et al.* 1995).

Sage-grouse populations can be significantly reduced, and in some cases locally extirpated, by non-renewable energy development activities, even when mitigative measures are implemented (Walker *et al.* 2007). The persistent and increasing demand for energy resources is resulting in their continued development within sage-grouse range, and may cause further habitat fragmentation. Although data are limited, impacts resulting from renewable energy development are expected to have negative effects to sage-grouse populations and habitats due to their similarity in supporting infrastructure (Becker *et al.* 2009; Hagen 2010; LeBeau 2012; USFWS 2012). Both non-renewable and renewable energy developments are increasing within the range of sage-grouse, and this growth is likely to continue given current and projected demands for energy.

Other factors associated with habitat loss and fragmentation are summarized by Knick *et al.* (2011) and include conversion of sagebrush habitats for agriculture, the expanding human populations in the western United States and the resulting urban development in sagebrush habitats, vegetation treatments resulting in the alteration or removal of sagebrush to enhance grazing for livestock, and impacts from wild ungulates and free-roaming equids (horses and burros).

Other threats that can negatively affect sage-grouse include, but are not limited to, parasites, infectious diseases, predation, and weather events (e.g., drought or late spring storms). Some of these threats may be localized and of short duration, but may be significant at the local population and habitat level, particularly for small populations. An example of this local effect was the 2008 outbreak of West Nile virus (WNv) in the sage-grouse population of southwestern North Dakota. Having no resistance to this threat (Walker and Naugle 2011), sage-grouse population numbers in North Dakota dropped dramatically following the WNv outbreak. Four years later (2012), the population had improved but not fully recovered to levels seen before the outbreak (North Dakota Game and Fish Department, unpublished data).

Predation is often identified as a potential factor affecting sage-grouse populations, which is understandable given the suite of predators that prey on sage-grouse from egg to adulthood (though no predators specialize on sage-grouse). Predator management has been effective on local scales for short periods, but its efficacy over broad ranges or over long timespans has not been demonstrated (Hagen 2011a). In areas of compromised habitats and high populations of synanthropic predators (predators that live near, and benefit from, an association with humans), predator control may be effective to ensure sage-grouse persistence until habitat conditions improve.

Though threats such as infectious diseases and predation may be significant at a localized level, particularly if habitat quantity and quality is compromised, they were not identified by FWS as significant range-wide threats in our 2010 warranted finding (75 FR 13910).

The occurrence and importance of each of the above threats to sage-grouse varies across the species' range. For example, fire and invasive weeds are the primary issue in the western portion of the species' range, while non-renewable energy development affects primarily the eastern portion of the species' range (75 FR 13910). However, no part of the species' range is immune from any of the primary threats described above. Additionally, the impact of threats on local sage-grouse populations likely varies based on the resilience of that population and its associated habitats. Healthy, robust sagebrush and seasonal habitats and associated sage-grouse populations with few or no other threats are likely to be more resilient than habitats already experiencing a high level of threats, or in poor condition. Natural conditions, such as long-term drought, can also affect habitat and population resilience. To capture the variability in threats and population resilience across the range of the sage-grouse we assessed threats to each population (see section 4, below).

The lack of sufficient regulatory mechanisms to conserve sage-grouse and their habitats was identified as a primary threat leading to our warranted but precluded finding in 2010 (75 FR 13910). While specific regulatory mechanisms are not addressed in this report, federal land management agencies, and many state and local governments across the species' range are working to develop adequate mechanisms to address this threat. For example, Wyoming's Governor Dave Freudenthal was among the first to enact regulatory mechanisms to protect core sage-grouse areas through Executive Order 2010-4. Governor Matt Mead signed an updated version of the Sage-Grouse Core Area Protection Executive Order in 2011 (Executive Order 2011-5). The Wyoming Executive Orders apply to all regulatory actions governed by the State of Wyoming, and as such, constitute substantial regulatory mechanisms that contribute to the conservation of sage-grouse. These efforts demonstrate the potential for successfully ameliorating the primary threats to sage-grouse and their habitat through the development and implementation of sufficient regulatory mechanisms.

4. CONSERVATION FRAMEWORK

Our conservation framework consisted of (1) identifying sage-grouse population and habitat status and threats (**see Section 2 and 3**, above), (2) defining a broad conservation goal (see **Section 4.2 section**, below), (3) identifying priority areas for conservation (see **this section**, below), and (4) developing specific conservation objectives and measures (see **Section 4.3**, below). We used three parameters—population and habitat representation, redundancy, and resilience (Shaffer and Stein 2010, Redford *et al.* 2011)—as guiding concepts in developing our conservation goal, priority areas for conservation, conservation objectives, and measures.

4.1 Guiding Concepts – Redundancy, Representation, and Resilience

Redundancy is defined as multiple, geographically dispersed populations and habitats across a species' range, such that the loss of one population or one unit of habitat will not result in the loss of the species. Redundancy allows for a margin of safety for a species and/or its habitat to withstand threats, including unforeseen catastrophes.

Representation is defined as the retention of genetic, morphological, physiological, behavioral, habitat, or ecological diversity of the species so its adaptive capabilities are conserved.

Resilience is defined as the ability of the species and/or its habitat to recover from disturbances. In general species are likely to be more resilient if large populations exist in large blocks of high quality habitat across the full breadth of environmental variability to which the species is adapted (Redford *et al*. 2011).

Redundancy, representation, and resilience were examined with respect to sage-grouse populations and their habitat. Populations are defined as a group of individuals occupying an area of sufficient size to permit normal dispersal and/or migration behavior in which numerical changes are largely determined by birth and death processes (Berryman 2002). Sage-grouse populations followed those identified in Garton *et al.* (2011), with the exception of Utah where populations were refined based on local population data provided by the State of Utah.

For sage-grouse, retaining redundancy, representation, and resilience means having multiple and geographically distributed sage-grouse populations across the species' ecological niche and geographic range. Large populations distributed across large areas are generally less vulnerable to extinction than small populations (Soulé 1987, Shaffer and Stein 2010). By conserving well distributed sage-grouse populations across geographic and ecological gradients, species adaptive traits can be preserved, and populations can be maintained at levels that make sage-grouse more resilient in the face of catastrophes or environmental change.

4.2 Conservation Goal

We defined our conservation goal as the long-term conservation of sage-grouse and healthy sagebrush shrub and native perennial grass and forb communities by maintaining viable, connected, and well-distributed populations and habitats across their range, through threat amelioration, conservation of key habitats, and restoration activities.

4.3 Priority Areas for Conservation

Effective conservation strategies are predicated on identifying key areas across the landscape that are necessary to maintain redundant, representative, and resilient populations. Fortunately, most of the individual states within the range of sage-grouse have already undertaken considerable efforts to identify and map key habitats necessary for sage-grouse conservation in the development of their state management plans for this species. We used these existing maps to identify the most important areas needed for maintaining sage-grouse representation, redundancy, and resilience across the landscape. These areas were named *Priority Areas for Conservation* (PACs) (Figure 2).

Although different techniques and processes were used across states to identify PACs, all used relatively similar population- and habitat-based data sources (Table 1).

Where PACs did not match at state boundaries efforts were made to resolve discrepancies. Most of the discrepancies were the result of mapping errors that were subsequently resolved, management differences that followed state boundaries due to differing regulatory mechanisms, or land ownership patterns between two states. Unresolved boundary concerns are being actively addressed by the states and PAC boundaries will be amended as these discrepancies are resolved.

There is substantial overlap between our PAC map and the preliminary priority habitat maps BLM developed for their range-wide Resource Management Plan revisions. This is because both efforts used maps provided by the states. The primary differences are in Nevada and Utah, where the map developed by these states does not exactly match the preliminary BLM planning map. Where there were unresolved differences, we used state maps to identify PACs, as states have the most complete local information of sage-grouse distribution and habitat use.

PACs do not represent individual populations, but rather key areas that states have identified as crucial to ensure adequate representation, redundancy, and resilience for conservation of its associated population or populations. Additional finer scale planning efforts by states may determine that additional areas outside of PACs are also essential.

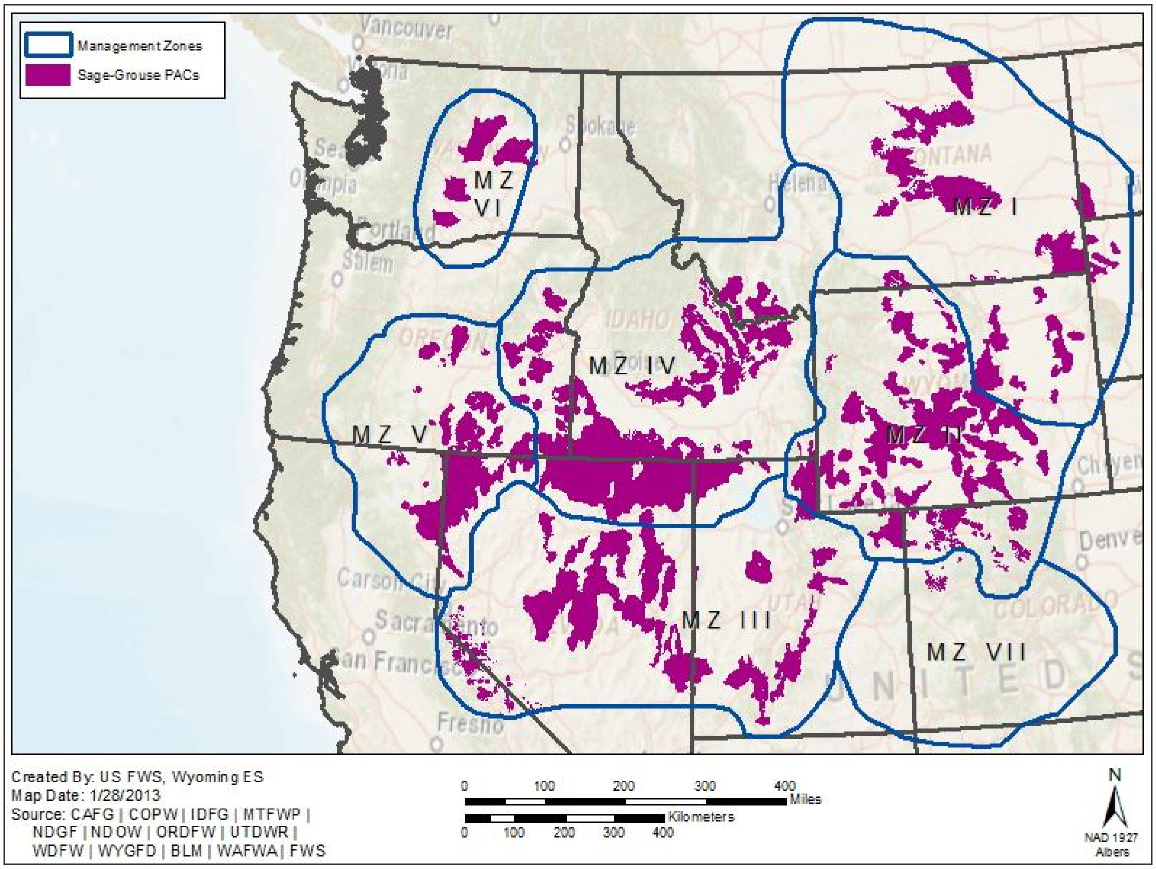

Figure 2. Sage-grouse management zones (Stiver *et al*. 2006) and Priority Areas for Conservation (PACs).

To capture the variability in threats and population resilience across the range of the sage-grouse we assessed the presence of threats to each population (Table 2) based on known occurrence of threats, existing management strategies, and professional experience. Not all threats or conservation needs are known with certainty. Areas of uncertainty include the effects of climate change and renewable energy development, the lack of robust information on population connectivity, the relationship between specific habitat characteristics and demographic parameters, and the lack of understanding of the processes necessary to restore sagebrush communities (Knick *et al*. 2003). These uncertainties do not undermine the foundation of PACs as crucial building blocks of a successful conservation strategy, but mean that some flexibility in our strategy will be necessary to retain options for the long-term conservation of the sage-grouse as new information becomes available.

Table 1. Sources of data used by states to develop Priority Areas for Conservation (PAC) maps for each state.

	CA	CO	ID	MT	ND	NV	OR	SD	UT	WA	WY
Population Based Data											
BBD/Lek Counts[a]	X	X	X	X	X	X	X		X	X	X
Telemetry	X	X	X	X		X	X	X	X	X	X
Nesting Areas	X	X		X	X	X			X	X	X
Known Distribution	X	X	X	X	X		X			X	X
Sightings/ Observations		X	X	X		X		X	X	X	X
Habitat Distribution[b]											
	X	X	X	X	X	X	X	X	X	X	X

[a]Breeding Bird Density (BBD) based on male counts at leks (Doherty *et al.* 2010)
[b]Habitat data included occupied habitat, suitable habitat, seasonal habitat, nesting and brood rearing areas, and connectivity areas or corridors.

Table 2. Sage-grouse quasi-extinction risk (from Garton *et al.* 2011), and threats, by management zone and population. Populations are those defined by Garton *et al.* (2011), although in some cases sub-populations were identified to help refine threat characterization (see Figure 3). Population estimates and quasi-extinction risk estimates are from Garton *et al.* (2011). Threats are characterized as: Y = threat is present and widespread, L = threat present but localized, N = threat is not known to be present, and U = Unknown.

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		>	% 2	% 2	% 2	% 2	M	I	S	A	F	C	W	E	M	I	G	F	R	U
Management Zone I: Great Plains			*9.5*	*11.1*	*22.8*	*24*														
Dakotas (*ND, SD*)	1	[illegible]	4.6	39.5	44.6	66.[illegible]	I	[illegible]	[illegible]	[illegible]	Y	U	[illegible]	Y	Y	[illegible]	L	[illegible]	N	[illegible]
Northern Montana (*MT*)	2	[illegible]	0	0	0.2	2.0	I	N	[illegible]	[illegible]	L	N	[illegible]	Y	N	Y	Y	[illegible]	L	N
Powder River Basin (*WY*)	3	N	2.9	16.5	85.7	86.2	I	N	L	N	L	L	Y	Y	Y	Y	Y	N	Y	L

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		[illegible]	% [illegible]	% [illegible]	% [illegible]	% [illegible]		I[illegible]	S[illegible]	A[illegible]	F[illegible]	C[illegible]	W[illegible]	E[illegible]	M[illegible]	I[illegible]	G[illegible]	F[illegible]	R[illegible]	U[illegible]
Yellowstone Watershed (*MT*)	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	I	[illegible]	[illegible]	[illegible]	L	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Management Zone II: Wyoming Basin																				
			0.1	0.3	16.1	16.2														
Eagle-South Routt (*CO*)	5	Y	ND	ND	ND	ND	II	Y	L	[illegible]	L	L	Y	Y	N	Y	Y	N	L	Y
Middle Park (*CO*)	6	N	2.5	100	7.1	100	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y
Laramie (*WY, CO*)	7	N	ND	ND	ND	ND	II	Y	N	N	Y	Y	Y	Y	U	Y	Y	N	Y	Y

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		> 2000 Males/ Birds	Chance of < 50 birds/ males in 2037 %	Chance of < 500 birds/ males in 2037 %	Chance of < 50 birds/ males in 2107 %	Chance of < 500 birds/ males in 2107 %		Isolated Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds/ Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
Jackson Hole (*WY*)	8	Y	11.[illegible]	100	17.[illegible]	100	II	[illegible]	[illegible]	[illegible]	L	[illegible]	[illegible]	Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wyoming Basin (*WY portion*)	9a	[illegible]	0.0	0.0	9.9	10.7	II	[illegible]	[illegible]	[illegible]	L	L	[illegible]	Y	L	Y	Y	[illegible]	Y	L
Rich-Morgan -Summit (*WY Basin in UT*)[1]	9b	N					II	N	N	N	Y	Y	Y	Y	N	Y	N	N	Y	Y
Uintah (*WY Basin in UT*)	9c	N					II	N	N	N	Y	Y	Y	L	Y	Y	N	N	Y	Y

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		>2007 M a sd B05/	% C hance of <50 2007 ni sd a m02	% C hance of <50 2037 ni sd a m002	% C hance of <50 2107 ni sd a m02	% C hance of <50 2107 ni sd a m002		I so l a ted / S m a ll S i	S a ge b ru sh E lim i	A g ri cu lt u r e Con v	F i re	C on i fers	W e e ds/ A nn u a l G	E n e r gy	M in i ng	I n f ra s t ru ct u re	G r a zi ng	F ree R oa m i ng E q	R ecre a t ion	U r b a n i za t ion
N. Park (*WY Basin in CO*)	9d	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	II	[illegible]	[illegible]	[illegible]	Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NWCO (*WY Basin in CO*)	9e	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	II	[illegible]	[illegible]	[illegible]	Y	L	[illegible]	Y	Y	[illegible]	Y	[illegible]	Y	L
Management Zone III: Southern Great Basin[2]			*0.0*	*0.0*	*6.5*	*7.8*														
Strawberry Valley (*Part of NE Interior UT*)	10a	Y	0.8	51.8	8.8	78.6	III	Y	N	N	Y	Y	Y	Y	N	Y	N	N	Y	N
Carbon (*Part of NE interior UT*)	10b	Y					III	Y	N	N	Y	N	Y	Y	Y	Y	N	N	Y	N

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		<200 M/<500 Birds	% Chance of <50 birds/20 males in 2037	% Chance of <500 birds/200 males in 2037	% Chance of <50 birds/20 males in 2107	% Chance of <500 birds/200 males in 2107		Isolated/Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
Sheeprock (*UT*, aka *Tooele-Juab Counties*)	11	Y	[illegible]	100	100	100	III	[illegible]	[illegible]	[illegible]	Y	[illegible]	[illegible]	Y	Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Emery (*UT*, *aka Sanpete-Emery Counties*)	12	[illegible]	17.7	100	9.2	100	III	Y	[illegible]	[illegible]	Y	Y	[illegible]	Y	Y	Y	N	[illegible]	Y	N
Greater Parker Mt. (*Part of South Central UT*)	13a	N	0.0	3.2	1.1	21.0	III	N	N	N	Y	Y	Y	N	N	Y	N	N	Y	N

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		>500 Males/Birds	% Chance of <50 birds/males in 2037	% Chance of <500 birds/males in 2037	% Chance of <50 birds/males in 2107	% Chance of <500 birds/males in 2107		Isolated Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free Roaming Equids	Recreation	Urbanization
Panguitch *(Part of South Central UT)*	13b						III	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y
Bald Hills *(Part of South Central UT)*	13c						III	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Northwest Interior (*NV*)	14	N	ND	ND	ND	ND	III	Y	N	N	Y	N	Y	U	Y	Y	Y	Y	Y	N
Ibapah (*UT part of Southern Great Basin*)	15a	Y	0.0	2.0	4.2	78.0	III	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		N > 200 Males/500 Birds	% Chance of <50 birds/males in 2037	% Chance of <500 birds/males in 2037	% Chance of <50 birds/males in 2107	% Chance of <500 birds/males in 2107	M	Isolated Small Size	Sagebrush Elimination	Agriculture Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
Hamlin Valley (*UT part of Southern Great Basin*)	15b	Y					III	N	N	N	Y	Y	Y	N	N	Y	N	N	N	N
Southern Great Basin (*NV portion*)	15c	N					III	L	L	L	Y	Y	Y	L	L	Y	Y	Y	Y	N
Quinn Canyon Range (*NV*)	16	Y	ND	ND	ND	ND	III	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N
Management Zone IV: Snake River Plains			*2.3*	*10.5*	*19.4*	*39.7*														
Baker (*OR*)	17	N	61.9	100	66.8	100	IV	Y	Y	Y	Y	L	Y	L	Y	L	U	N	L	L

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					MZ	Threats												
		>200 Males / 500 Birds	Chance of <50 birds in 2037 %	Chance of <500 birds in 2037 %	Chance of <50 birds in 2107 %	Chance of <500 birds in 2107 %		Isolated/Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
East Central (*ID*)	18	N	ND	ND	ND	ND	IV	[illegible]	[illegible]	Y	L	Y	[illegible]	Y	N	Y	Y	Y	L	L
Southwest Montana (*Bannack, Red Rocks, Wisdom, and Bridges*)	19-22	N	Bannack: 26.4 Red Rock: 0.1	Bannack: 70.2 Red Rock: 55.3	Bannack: 32.7 Red Rock: 2.5	Bannack: 97.7 Red Rock: 91.9	IV	N	[illegible]	N	L	L	Y	L	L	L	Y	N	L	L
Snake-Salmon-Beaverhead (*ID*)	23	N	4.2	10.2	19.3	26.8	IV	N	L	L	Y	L	Y	Y	N	L	Y	Y	L	N
Belt Mountains (*MT*)	24	Y	ND	ND	ND	ND	IV	Y	L	Y	L	L	Y	L	N	L	Y	N	L	L

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		> 200 Males / 500 Birds	% Chance of < 50 birds/ 20 males in 2037	% Chance of < 500 birds/ 200 males in 2037	% Chance of < 50 birds/ 20 males in 2107	% Chance of < 500 birds/ 200 males in 2107		Isolated / Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds / Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
Weiser (*ID*)	25		ND	ND	ND	ND	IV													
Northern Great Basin (*OR, ID, NV portion*)	26a		2.1	2.5	2.5	9.7	IV				Y	Y		L	L	Y	Y		Y	Y
Box Elder (*UT portion of Northern Great Basin*)	26b	N					IV	N	N	Y	Y	Y	Y	L	Y	Y	N	N	Y	N
Sawtooth (*ID*)	27	Y	ND	ND	ND	ND	IV	Y	L	N	L	U	L	N	N	Y	Y	N	L	N

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		<	% 2	% 2	% 2	% 2		I	S	A	F	C	W	E	M	I	G	F	R	U
Management Zone V: Northern Great Basin			***1.0***	***2.1***	***7.2***	***29***														
Central Oregon (*OR*)	28	[illegible]	<4.2	<15.2	<74.0	<91.3	V	[illegible]	[illegible]	L	Y	Y	Y	L	Y	L	Y	[illegible]	L	L
Klamath (*OR, CA*	29	Y	ND	ND	100	100	V	Y	U	U	Y	Y	Y	L	N	U	U	U	U	U
Warm Springs Valley (*NV*)	30	Y	ND	ND	ND	ND	V	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		>2007 …	% Change of … 2008 …	% Change of … 2009 …	% Change of … 2012 …	% Change of … 2012 …		I…	S…	A…	F…	C…	W…	E…	M…	I…	G…	F…	R…	U…
Western Great Basin (*OR*, *CA*, *NV*)	31	[illegible]	5.5	6.[illegible]	6.4	9.[illegible]	V	[illegible]	[illegible]	[illegible]	Y	[illegible]	[illegible]	L	L	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Management Zone VI: Columbia Basin			*12.4*	*76.2*	*62.1*	*86.3*														
Moses Coulee (*WA*)	32a	N	9.8	87.6	62.4	99.8	VI	Y	Y	Y	L	N	Y	Y	N	Y	Y	N	Y	Y
Crab Creek (*WA*)	32b	Y	ND	ND	ND	ND	VI	Y	Y	Y	Y	L	Y	Y	N	Y	Y	N	Y	L

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		<200 Males/500 Birds	% Chance of <50 birds/200 males in 2037	% Chance of <500 birds/2000 males in 2037	% Chance of <50 birds/200 males in 2107	% Chance of <500 birds/2000 males in 2107		Isolated/Small Size	Sagebrush Elimination	Agricultural Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Grazing	Free-Roaming Equids	Recreation	Urbanization
Yakama Indian Nation (*WA*)	33a	Y	ND	ND	ND	ND	VI	Y	N	L	Y	N	Y	Y	N	Y	Y	Y	Y	N
Yakima Training Center (*WA*)	33b	Y	26.1	100	50.4	100	VI	Y	N	[illegible]	Y	N	Y	N	N	Y	Y	N	Y	N
Management Zone VII: Colorado Plateau			***0.0***	***95.6***	***5.1***	***98.4***														
Parachute-Piceance-Roan Basin (CO)	34	Y	ND	ND	ND	ND	VII	Y	L	N	Y	Y	L	Y	Y	Y	Y	Y	N	N

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		<	%	%	%	%		I	S	A	F	C	W	E	M	I	G	F	R	U
Meeker-White River (*CO*)	35		ND	ND	ND	ND	VII				Y									
Bi-State Distinct Population Segment																				
North Mono Lake (*CA*, *NV*)	36	N	15.4	100	37.9	100	III	Y	L	Y	Y	Y	Y	L	Y	Y	Y	Y	Y	Y
South Mono Lake (*CA*)	37	N	0.1	81.5	0.6	99.9	III	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Pine Nut (*NV*)	38	Y	ND	ND	ND	ND	III	Y	L	U	Y	Y	Y	N	L	Y	Y	Y	Y	Y

Population	Unit Number	Population Abundance and Estimated Quasi-extinction Risk					M	Threats												
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		I	S	A	F	C	W	E	M	I	G	F	R	U
White Mountains (*CA, NV*)	39	[illegible]	ND	ND	ND	ND	III	[illegible]	[illegible]	[illegible]	Y	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] This UT management area includes Summit-Morgan Counties, which is described separately by Garton *et al.* (2011) as a subpopulation in Management Zone III. Numbers for columns 4-7 for this population are 20.6, 100, 41.8, and 100, respectively (Garton *et al.* 2011).

[2] Percentages reported in this zone by Garton *et al.* (2011) include information for North and South Mono Lake, which are separately described in the Bi-State section of this table.

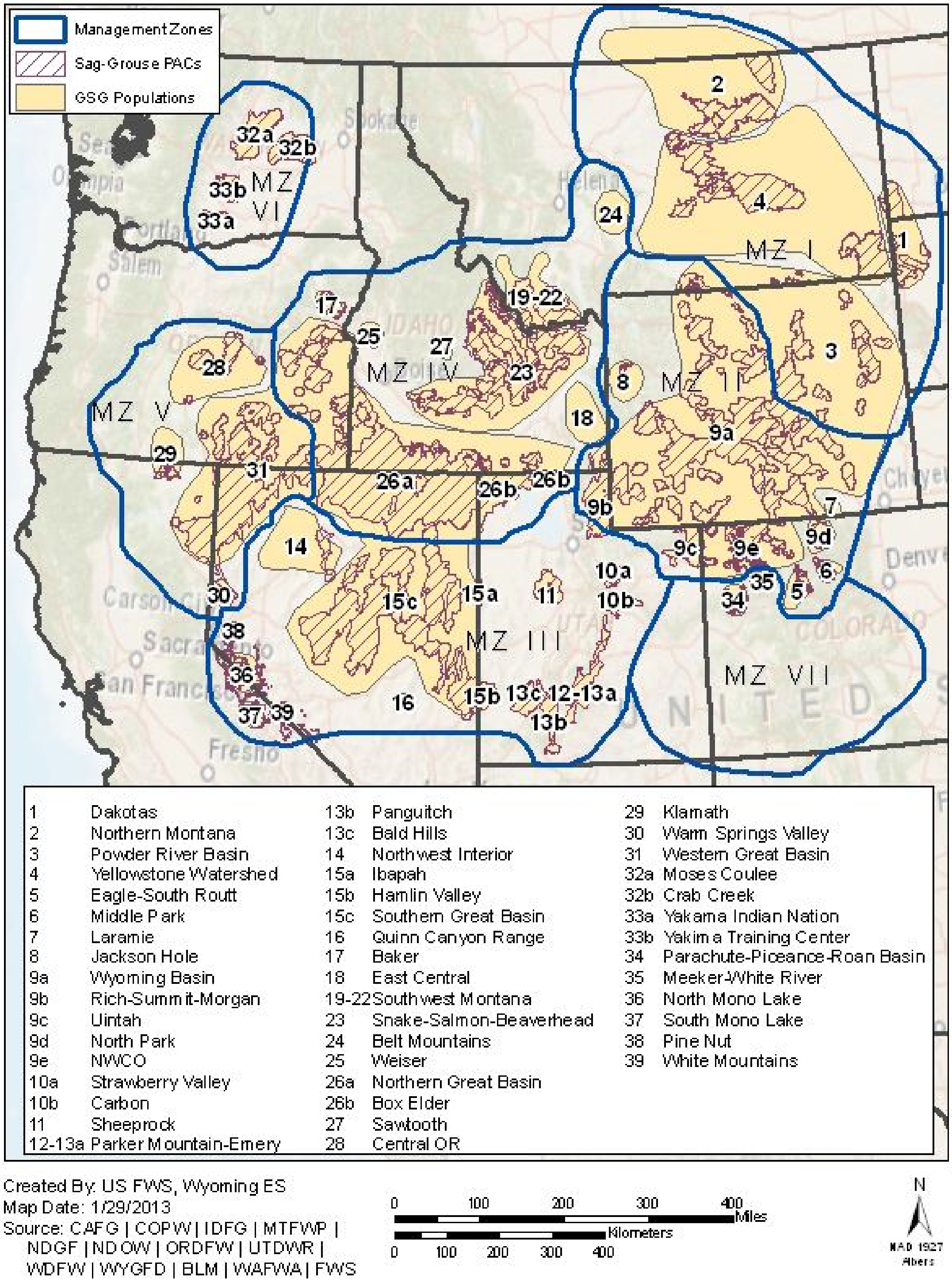

Figure 3. Sage-grouse management zones (Stiver *et al*. 2006), populations (adapted from Garton *et al.* 2011), and Priority Areas for Conservation (PACs; see Section 4.3). Threats to the populations identified here are described in Table 2.

5. CONSERVATION OBJECTIVES

The conservation objectives identified below are targeted at maintaining redundant, representative, and resilient sage-grouse habitats and populations. Due to the variability in ecological conditions and the nature of the threats across the range of the sage-grouse, developing detailed, prescriptive species or habitat actions is not possible at the range-wide scale. Specific strategies or actions necessary to achieve the following conservation objectives must be developed and implemented at the state or local level, with the involvement of all stakeholders.

In developing conservation objectives for the sage-grouse we identified the following uncertainties that limit our ability to prescribe a precise level of threat amelioration needed to conserve redundancy, representation and resilience to ensure long-term conservation of sage-grouse, especially on a range-wide level:

1. The lack of robust, range-wide genetics-based connectivity analyses;

2. The ability to successfully restore lower-elevation and weed-infested habitats is currently limited by a lack of complete understanding of underlying ecological processes, and in some areas because alteration of vegetation, nutrient cycles, topsoil, and living (cryptobiotic) soil crusts has exceeded recovery thresholds (Knick *et al*. 2003; Pyke 2011). Additionally, resources for restoration activities are often limited; and,

3. The effect of climate change on the amount and distribution of future habitat is largely unknown.

In light of these significant uncertainties, impacts to sage-grouse and their habitats should be avoided to the maximum extent possible to retain conservation options. This approach will ensure that potentially unidentified key components to long-term viability of sage-grouse are not lost, and that management flexibility and the ability to implement management changes will be retained as current information gaps are filled. Implementing an avoidance first strategy should reduce or avoid continuing declines of sage-grouse populations and habitats, as well as limit further reduction in management and restoration options. When avoidance is not possible, meaningful minimization and mitigation of the impacts should be implemented, along with a monitoring program to evaluate the efficacy of these measures. Conservation measures should be adapted to maximize effectiveness as new knowledge is obtained.

General Conservation Objectives

1. *Stop population declines and habitat loss.* There is an urgent need to "stop the bleeding" of continued population declines and habitat losses by acting immediately to eliminate or reduce the impacts contributing to population declines and range erosion. There are no

populations within the range of sage-grouse that are immune to the threat of habitat loss and fragmentation.

a) Achieving this objective requires eliminating activities known to negatively impact sage-grouse and their habitats, or re-designing these activities to achieve the same goal. As described in our 2010 warranted but precluded finding (75 FR 13910, and references therein), local sage-grouse extirpations and habitat losses have already reduced management (and therefore recovery) options in some portions of the species' range (e.g. the Columbia Basin, Washington). Further, many populations are declining (WAFWA 2008; Garton *et al*. 2011) due to past and ongoing habitat loss, degradation and fragmentation, and many face significant threats (Table 2), or are inherently challenged by current population size (as discussed in section 4, above). Implementing an avoidance first strategy should minimize continuing declines in the species and its habitats, as well as limit further reduction in management options.

b) The appropriate level of management must continue to effectively conserve all current PACs. Threats in PACs must be minimized to the extent that population trends meet the objectives of the 2006 WAFWA Conservation Strategy (Stiver *et al*. 2006; see discussion regarding specific threat amelioration objectives below). Additionally, PACs should be managed to maintain, and improve degraded habitats to provide healthy intact sagebrush shrub and native perennial grass and forb communities, appropriate to the local ecological conditions, and to conserve all essential seasonal habitat components for sage-grouse.

2. *Implement targeted habitat management and restoration*. Some sage-grouse populations warrant more than the amelioration of the impacts from stressors to maintain sage-grouse on the landscape. In these instances, and particularly with impacts resulting from wildfire, it may be critical to not only remove or reduce anthropogenic threats to these populations but additionally to improve population health through active habitat management (e.g. habitat restoration). This is particularly important for those populations that are essential to maintaining range-wide redundancy and representation.

    a) Removal of all threats may not be sufficient to change the status of some populations, as some of these populations (and associated PACs) are subject to non-anthropogenic threats (e.g., lighting-caused fires) or may have already declined to a point where active management is required for their long-term viability (e.g., Clear Lake area of northern California). In these cases, proactive management of non-anthropogenic threats (e.g., strategic placement of fire-fighting resources) and restoration efforts should be implemented.

    b) The effectiveness of restoration activities (ultimately determined by sage-grouse use and population trends) must be demonstrated prior to receiving any credit for mitigating losses. Restoration activities should be developed within a framework that allows for necessary adjustments.

c) Effective habitat conservation and, as appropriate, restoration activities, should be implemented immediately. The typically long response times of sagebrush ecosystems to most management activities necessitates that these activities be initiated so that their results can be considered for long-term conservation strategies. Development and Implementation of monitoring plans for these activities is an essential component of these efforts.

d) Some areas that were not included as PACs may still have great potential for providing important habitat if active habitat management is implemented. For example, removal of early-stage juniper stands may render currently unsuitable habitat into effective habitat for sage-grouse (this is also true for degraded habitats within PACs). State and federal agencies should actively pursue these opportunities. Successful habitat management efforts could increase connectivity between PACs, and will enhance management flexibility in conserving the species.

3. *Develop and implement state and federal sage-grouse conservation strategies and associated incentive-based conservation actions and regulatory mechanisms.* To conserve sage-grouse and habitat redundancy, representation, and resilience, state and federal agencies, along with interested stakeholders within range of the sage-grouse should work together to develop a plan, including any necessary regulatory or legal tools (or use an existing plan, if appropriate) that includes clear mechanisms for addressing the threats to sage-grouse within PACs. Where consistent with state conservation plans, sage-grouse habitats outside of PACs should also be addressed. We recognize that threats can be ameliorated through a variety of tools within the purview of states and federal agencies, including incentive-based conservation actions or regulatory mechanisms. Federal land management agencies should work with states in developing adequate regulatory mechanisms. Federal land management agencies should also contribute to the incentive-based conservation and habitat restoration and rehabilitation efforts.
In the development of conservation plans, entities (states, federal land management agencies, etc.) should coordinate with FWS. This will ensure that the plans address the threats contributing to the 2010 warranted but precluded determination, and that conservation strategies will meaningfully contribute to future listing analyses.

a) Successful implementation of regulatory and incentive-based mechanisms to conserve sage-grouse requires that all stakeholders participate in conservation, regardless of the size, type, ownership, or location of the threat impact. Continued losses by controllable individual activities of any size can result in significant impacts to the conservation of the species when considered cumulatively, and these losses also reduce management options.

b) Sage-grouse conservation strategies should consider using the criteria identified in the FWS/NOAA Fisheries *Policy for Evaluation of Conservation Efforts (PECE) when Making Listing Decisions* (Federal Register/Vol. 68, No. 60/Friday, March

28, 2003; Appendix B) to help evaluate its likely implementation and effectiveness.

i. Conservation plans should:
    1. Be based on the best available science;
    2. Use local data on threats and ecological conditions, including status of local sage-grouse populations and their associated habitats;
    3. Maintain the diversity of sagebrush habitats essential to provide for all sage-grouse seasonal and life history stages;
    4. Maintain genetic and physical connectivity; and,
    5. Maintain all current intact sage-grouse habitats according to the state management plans (developed in coordination with FWS as discussed above) or other conservation efforts (e.g., BLM priority areas), recognizing existing valid rights.

ii. Conservation plans should be completed no later than July 2013 for the Bi-State DPS, and September of 2014 for the rest of the species' range.

c) Regulatory mechanisms must be completed and implemented and incentive-based conservation actions negotiated as quickly as possible (no later than July 2013 for the Bi-State DPS and September 2014 for the rest of the sage-grouse range, including the Columbia Basin DPS). The effectiveness of regulatory mechanisms and incentive-based conservation activities will be assessed on whether such efforts will successfully ameliorate the specific threats associated with each population and its' associated PACs (See Table 2 in Part 5). Regulatory mechanisms and incentive-based actions should address all threats to PACs to the maximum extent practicable.

d) If adequate regulatory mechanisms cannot be implemented prior to July 2013 for the Bi-State DPS, and Sept. 2014 for the species across the rest of its range, then enforceable temporary measures should be considered in order to ensure threats will be at least temporarily ameliorated until such time that an effective regulatory mechanism can be implemented.

e) All regulatory and incentive-based mechanisms should have a monitoring plan that will provide scientifically defensible data regarding their effectiveness. New or adapted mechanisms must be developed and implemented if monitoring determines that current regulatory mechanisms are ineffective.

4. *Develop and implement proactive, voluntary conservation actions*. Proactive, incentive-based, voluntary conservation actions (e.g. Candidate Conservation Agreements with Assurances, Natural Resources Conservation Service programs) should be developed and/or implemented by interested stakeholders and closely coordinated across the range of the species to ensure they are complimentary and address sage-grouse conservation needs and threats. These efforts need to receive full funding, including funding for necessary personnel.

Many stakeholders within the sagebrush ecosystem have been working diligently to proactively minimize the impacts of their projects on the sage-grouse. Currently, proactive voluntary conservation actions for sage-grouse are being implemented in many parts of the species' range. Given the vast extent of the species' range implementation of voluntary conservation actions may not provide all actions necessary for conservation of the species range-wide. Nevertheless, the combination of voluntary efforts and active management by state and federal agencies via habitat improvements and governmental regulatory mechanisms could have a significant influence on the Service's upcoming listing determinations. These combined actions should apply to the activities which cause habitat fragmentation and loss, the primary factor identified in the FWS 2010 warranted but precluded finding. Stakeholders engaged in voluntary conservation actions should collect information on the geographic scope of these efforts, the sustained benefits to sage-grouse from their implementation, and the likelihood that they will continue to be implemented in the future. This information will be essential to informing the FWS listing decisions.

a) Funding and other necessary support for current proactive conservation efforts should be continued.

b) All proactive voluntary conservation efforts should use the best available science to develop and implement management actions. The results of these efforts should be tracked and reported annually. To monitor effectiveness, these efforts should have a monitoring plan which will provide the necessary scientifically-based information that allows for modification if necessary to achieve the conservation objective.

5. *Develop and implement monitoring plans to track the success of state and federal conservation strategies and voluntary conservation actions*. A robust range-wide monitoring program must be developed and implemented for sage-grouse conservation plans, which recognizes and incorporates individual state approaches. A monitoring program is necessary to track the success of conservation plans and proactive conservation activities. Without this information, the actual benefit of conservation activities cannot be measured and there is no capacity to adapt if current management actions are determined to be ineffective.

a) Adequate funding must be secured for development, implementation, and enforcement of regulatory and incentive-based mechanisms, other conservation strategies, and monitoring programs.

b) New or adapted management actions must be developed and implemented if the monitoring determines that current management actions are ineffective.

6. *Prioritize, fund, and implement research to address existing uncertainties.* Increased funding and support for key research projects that will address uncertainties associated with sage-grouse and sagebrush habitat management is essential. Effective amelioration

of threats can only be accomplished if the mechanisms by which those threats are imposed on the redundancy, representation, and resilience of the species and its habitats are understood.

Specific Conservation Objectives

Priority Areas for Conservation (PACs)

Delineation of key sage-grouse habitats recognizes the extensive reach of habitat threats, the existing loss and degradation of habitats, and acknowledges that preservation of every remaining area of sage-grouse habitat is improbable (Kiesecker *et al*. 2011). Priority Areas for Conservation (PACs) are key habitats identified by state sage-grouse conservation plans (for each state that has such a plan), or through other sage-grouse conservation efforts (e.g. the current BLM planning effort for greater sage-grouse). Maintenance of the integrity of PACs (i.e., maintenance of a healthy sagebrush shrub and native perennial grass and forb community appropriate to local site ecological conditions, which conserves all essential habitat components for sage-grouse) is the essential foundation for sage-grouse conservation. Threats in PACs must be minimized as part of the effort to meet the objectives of the 2006 WAFWA Conservation Strategy (Stiver *et al*. 2006). These objectives include reversing negative population trends within each Management Zone **and** achieving a positive or neutral population trend, with long-term success assessed by comparison with trend data from 1965 – 2003 for each Management Zone. Application of the following conservation objectives (as applicable to local conditions) is unlikely to result in immediate, detectable changes in sage-grouse population trends. However, incorporation of these objectives into conservation planning efforts, including rigorous monitoring plans, will help provide the assurance that the long-term population trend objectives are likely to be attained.

Sage-grouse habitats outside of PACs may also be essential, by providing connectivity between PACs (genetic and habitat linkages), habitat restoration and population expansion opportunities, and flexibility for managing habitat changes that may result from climate change. There may also be seasonal habitats outside of PACs essential to meeting the year-round needs of sage-grouse within PACs but that have not yet been identified. Therefore, maintaining habitats outside of PACs may be important (Fedy *et al.* 2012). Conservation of sage-grouse habitats outside of the PACs should be closely coordinated with each state. For those states with sage-grouse management plans, or similar documents adequately addressing the conservation of sage-grouse that have been developed in coordination with FWS, decisions on management of those areas should defer to those plans. Conservation of habitats outside of PACs should include minimization of impacts to sage-grouse and healthy native plant communities. If minimization is not possible due to valid existing rights, mitigation for impacted habitats should occur.

Loss of PACs (e.g., through wildfire) will reduce the long-term viability of the greater sage-grouse and its habitats. The precise impact of the loss of a PAC, or part of a PAC, to the long-term conservation of sage-grouse cannot be predicted, as the impact will depend on location and size of the PAC and the extent of habitat lost. Nevertheless loss of a PAC, or significant reduction in available habitat within a PAC, will reduce redundancy and representation across the sage-grouse range, thereby increasing the risk of local extirpation, loss of population connectivity, and reducing management options. Therefore, it is imperative that no PACs are lost as a result of further infrastructure development or other anthropogenic impacts.

The following objectives are targeted at conserving PACs, but can be applied to sage-grouse habitats outside of PACs. These objectives apply to both the Bi-State DPS and sage-grouse range-wide. Achieving these objectives will conserve redundancy and representation of the species and its habitats across its range.

1. Retain sage-grouse habitats within PACs. This must be a priority. Restoration of these habitats, once lost, is difficult, expensive, and based on current knowledge, success may be limited.

2. If PACs are lost to catastrophic events, implement appropriate restoration efforts (Pyke 2011). Given that adequate restoration is often very difficult and takes many years, in addition to restoration, efforts should be made to restore the components lost within the PAC (e.g., redundancy or representation) in other areas such that there is no net loss of sage-grouse or their habitats.

3. Restore and rehabilitate degraded sage-grouse habitats in PACs. This will require sufficient funding and resources, a scientifically rigorous monitoring plan, and the ability to change management if the monitoring results so indicate.

4. Identify areas and habitats outside of PACs which may be necessary to maintain the viability of sage-grouse. If development or vegetation manipulation activities outside of PACs are proposed, the project proponent should work with federal, state or local agencies and interested stakeholders to ensure consistency with sage-grouse habitat needs.

5. Re-evaluate the status of PACs and adjacent sage-grouse habitat at least once every 5 years, or when important new information becomes available (e.g. identification of a previously unknown important winter habitat area). PAC boundaries should be adjusted based on new information regarding habitat suitability and refined mapping techniques, new genetic connectivity information, and new or updated information on seasonal range delineation. By maintaining current maps of the habitat areas necessary to provide redundancy and representation, conservation plans can be more accurately implemented, or modified if appropriate. Additionally, new restoration or rehabilitation opportunities may be identified, thereby increasing management flexibility. Basing management decisions on out-of-date data or natural resource dogma (Beck *et al*. 2012) may threaten the success of long-term conservation actions and conservation plans.

6. Actively pursue opportunities to increase occupancy and connectivity between PACs. Some areas that were not included as PACs may still have great potential for providing important habitat if active habitat management is implemented.

7. Maintain or improve existing habitat conditions in areas adjacent to burned habitat. In the late summer of 2012, several large wildfires in the Great Basin burned through sage-grouse habitats, including PACs (Figure 3). Significant sage-grouse habitat losses were sustained in PACs across California, Nevada, Idaho and Oregon, and in PACs that border those state boundaries. Acreage within fire perimeters in PACs total 265,151 acres in California, 486,293 acres in Nevada, 286,820 acres in Idaho, and 695,619 acres in Oregon. The resulting, immediate loss of habitat raises concerns for the capacity of at least some of those PACs to sustain sage-grouse populations. The unburned portions of these PACs cannot tolerate further impacts to sage-grouse without risking additional population declines. Funding for restoration activities to restore habitat and connectivity in these areas must be a priority. Minimizing or eliminating anthropogenic activities in surrounding, unburned PACs and sage-grouse habitats outside of PACs must also be a priority to enhance opportunities for re-establishment of connectivity among populations, and subsequent re-colonization of restored areas. Management actions within those surrounding PACs must strive to maintain or improve existing habitat conditions so that when a fire occurs, there is a greater chance for successful habitat recovery. Research to understand sage-grouse response to these fires should be prioritized so that any appropriate management modifications, including the modification or addition of PACs, can be implemented.

Threat Reduction

The following threat reduction objectives and measures are targeted at the habitat threats facing the greater sage-grouse, as identified in the 2010 warranted but precluded finding (75 FR 13910). Successful achievement of these objectives across the species' range will ameliorate the threats to greater sage-grouse, including the Bi-State DPS, and allow for the long-term conservation of the species. In the development of conservation plans to achieve these threat reduction objectives, entities (states, federal land management agencies, etc.) should coordinate with FWS. This will help to ensure that the conservation plans adequately address the threats contributing to the 2010 warranted but precluded finding.

The March 2010 finding determined that the greater sage-grouse was warranted for listing based on two primary factors – the present or threatened destruction, modification or curtailment of habitat or range, and the inadequacy of existing regulatory mechanisms. The following strategies addressing resilience are therefore focused on the first listing factor – habitat. In many situations adequate regulatory mechanisms are essential to addressing habitat concerns. The adequacy of regulatory mechanisms is being addressed via several other venues, including the land management planning that the FS and BLM are engaged in and the development and implementation of individual state management plans. Other factors may have local impacts on sage-grouse and state management plans developed in coordination with FWS should provide a basis for addressing these concerns. However, because those other factors did not rise to the level of warranting a listing range-wide (e.g., disease), they are not addressed in this report. Resolution of the habitat concerns discussed below will assist in addressing these other local factors and therefore, these efforts are not mutually exclusive.

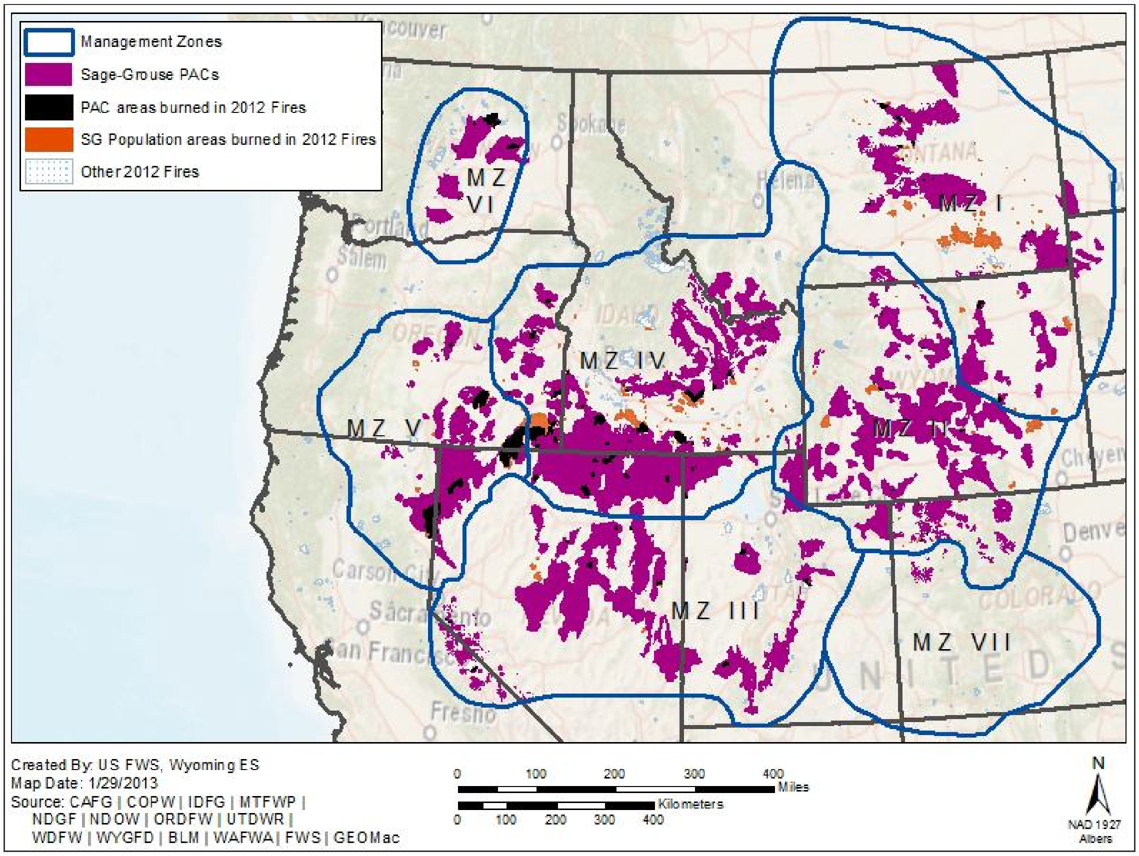

Figure 4. Sage-grouse management zones (Stiver *et al*. 2006), Priority Areas for Conservation (PACs), and 2012 fire perimeters within or near sage-grouse populations. Areas in black indicate areas of PACs that burned while areas in orange indicate areas within the range of sage-grouse, but outside of PACs that burned.

In instances where local data are available for addressing any of the objectives outlined below, they should be used. Where local data are not available information from peer-reviewed literature and rigorous scientific studies should be used to develop local management targets (e.g. amount of understory cover necessary to improve nesting success).

Brief summaries of the impacts of each habitat threat described below are provided as a general reference only. The March, 2010 listing determination (75 FR 13910) provides more detailed analyses of these threats. In addition to identifying conservation objectives associated with each threat we also provide conservation measures that are likely to help achieve that objective. For some threats, examples of options to assist in achieving the conservation objective are also provided for consideration. We did not identify objectives for addressing the potential impacts of climate change due to the uncertainties associated with modeling the resulting future condition and distribution of sage-brush habitats. However, conservation plans should consider climate change models, using local data when available, in the management of sage-grouse habitats.

The following objectives apply to PACs, but all opportunities to reduce threats within sage-grouse habitats should be considered. Where conservation actions are essential outside of PACs, it is noted in the objectives below. These objectives apply to both the Bi-State DPS, and sage-grouse range-wide.

Fire

Conservation Objective: Retain and restore healthy native sagebrush plant communities within the range of sage-grouse.

Fire (both lightning-caused and human-caused fire) in sagebrush ecosystems is one of the primary risks to the greater sage-grouse, especially as part of the positive feedback loop between exotic invasive annual grasses and fire frequency. As the replacement of native perennial bunchgrass communities by invasive annuals is a primary contributing factor to increasing fire frequencies in the sagebrush ecosystem, every effort must be made to retain and restore this native plant community, both within and outside of PACs.

Conservation Measures:

1. Restrict or contain fire within the normal range of fire activity (assuming a healthy native perennial sagebrush community), including size and frequency, as defined by the best available science.
2. Eliminate intentional fires in sagebrush habitats, including prescribed burning of breeding and winter habitats.
3. Design and implement restoration of burned sagebrush habitats to allow for natural succession to healthy native sagebrush plant communities. This will necessitate an intensive and well-funded monitoring system for this long-term endeavor. To be considered successful, restoration must also result in returning or increasing sage-grouse populations within burned areas.
4. Implement monitoring programs for restoration activities. To ensure success, monitoring must continue until restoration is complete (establishment of mature, healthy native sagebrush plant communities), with sufficient commitments to make adequate corrections to management efforts if needed.
5. Immediately suppress fire in all sagebrush habitats. Where resources are limited, these actions should first focus on PACs and any identified connectivity corridors between PACs.

Threat reduction for fire is difficult and costly. Given the intensity and wide distribution of this threat it may never be fully addressed. However implementing the suite of conservation measures listed above is likely to significantly reduce the impact of fire on the long-term viability of the sage-grouse.

Addressing fire, and subsequent successful restoration activities, in sagebrush ecosystems will require consideration of local ecological conditions, which cannot be prescribed on a range-wide level. Where state sage-grouse management plans already provide an effective strategy for fire, the COT defers to those efforts. In all other situations, the following options should be considered in developing a fire management strategy. Specific strategies for reducing the threat of fire should be drafted by July 2013 for the Bi-State population and by September 2014 for sage-grouse rangewide, and should consider the criteria outlined in the PECE policy (Appendix B).

Conservation Options:

1. Prevention of fires in sage-grouse habitats
    a. Manage for the maintenance and, where necessary, restoration of healthy perennial grass (Blank and Morgan 2012) and sagebrush vegetative communities.
    b. Manage land uses (e.g., improper livestock grazing, OHV and recreational use, roads) to minimize the spread of invasive species and or facilitate fire ignition.
    c. Address degraded sagebrush systems before fire occurs (e.g., improve grazing systems).
    d. Close rangelands that are highly susceptible to fire to OHV use during the fire season.

2. Quickly suppress fires that do occur
    a. Implement policy changes that allow access to more fire suppression resources, such as Air National Guard Mobile Airborne Firefighting Units.
    b. Re-allocate fire response resources (crews, equipment, etc.) to important sage-grouse habitats. Identify where resources are lacking and provide those resources to decrease response time to fires in sage-grouse habitats.
    c. Establish defensible fire lines in areas where: (i) effectiveness is high, (ii) fire risk is likely, and (iii) negative impacts from these efforts (e.g. fragmentation) are minimized. Avoid use of any vegetative stripping in healthy, unfragmented habitats, unless fire conditions and local ecological conditions so warrant.
    d. Carefully consider the use of backfires within PACs to minimize the potential for escape and further damage to sage-grouse and sagebrush habitats.
    e. Provide education of fire personnel on the need and value of protecting sagebrush landscapes.
    f. Remove pinyon-juniper stands which are highly flammable (stands where trees are the dominant vegetation and the primary plant influencing ecological processes (Phase 3; Miller *et al*. 2008)) in low elevation sagebrush habitats.
    g. Reduce risk of human-caused fires by limiting activities that may result in fire (e.g., fire bans for campers, limit OHV use to roads) during high risk fire seasons.
    h. Provide incentives for suppressing fires in sagebrush habitats.
    i. Federal land management agencies should consider placing additional firefighting resources and establish new Incident Attack Centers in or adjacent to PACs.
    j. Firefighters should ensure close coordination with firefighters from other management agencies and local fire departments. Additionally they should seek

local expertise to create the best possible strategies for responding to and suppressing wildfire.

3. Improve restoration support
    a. Consider re-allocation of funding from other habitat work to restoration of sage-grouse habitats affected by fire.
    b. Address shortage of locally-adapted seed and storage capabilities.
    c. Apply available seed where it is most likely to be effective and to areas of highest need.
    d. Ensure sage-grouse habitat needs are considered in restoration efforts including managing for the range of variation, as appropriate for the local area.
    e. In the case of limited resources, prioritize PACs over habitats outside of PACs for restoration efforts.

4. Renew and implement BLM Instructional Memorandum (IM) 2011-138 (Sage-grouse Conservation Related to Wildland Fire and Fuels Management; Bureau of Land Management 2011) until a decision is made on whether to incorporate the measures identified in the IM into Resource Management Plans.

Non-native, Invasive Plant Species

The increase in mean fire frequency has been facilitated by the incursion of nonnative annual grasses, primarily *Bromus tectorum* and *Taeniatherum asperum*, into sagebrush ecosystems (Billings 1994; Miller and Eddleman 2001). Exotic annual grasses and other invasive plants also alter habitat suitability for sage-grouse by reducing or eliminating native forbs and grasses essential for food and cover (75 FR 13910, and references therein). Annual grasses and noxious perennials continue to expand their range, facilitated by ground disturbances, including wildfire (Miller and Eddleman 2001), improper grazing (Young *et al*. 1972, 1976), agriculture (Benvenuti 2007), and infrastructure associated with energy development (Bergquist *et al*. 2007). Management of this threat is two-pronged: (1) control, or stopping the spread of invasive annual grasses, and (2) reduction or elimination of established invasive annual grasses. These activities should be prioritized in all sagebrush habitats, both within and outside of PACs because once established, invasive annual grasses are extremely difficult to control.

Conservation Objective: Maintain and restore healthy, native sagebrush plant communities.

Conservation Measures:

1. Retain all remaining large intact sagebrush patches, particularly at low elevations.
2. Reduce or eliminate disturbances that promote the spread of these invasive species, such as reducing fires to a “normal range” of fire activity for the local ecosystem, employing grazing management that maintains the perennial native grass and shrub community appropriate to the local site, reducing impacts from any source that allows for the

invasion by these species into undisturbed sagebrush habitats, and precluding the use of treatments intended to remove sagebrush.
3. Monitor and control invasive vegetation post-wildfire for at least three years.
4. Require best management practices for construction projects in and adjacent to sagebrush habitats to prevent invasion.
5. Restore altered ecosystems such that non-native invasive plants are reduced to levels that do not put the area at risk of conversion if a catastrophic event were to occur. This is especially important within Wyoming big sagebrush communities as these cover types are the most at risk to displacement by cheatgrass (Wisdom *et al.* 2005). While complete elimination of non-native invasive plants would be ideal, we acknowledge that this is unlikely given our current understanding of underlying ecological processes, shifts in climate, and lack of resources.

Energy Development

The increasing demand for renewable and non-renewable energy resources is resulting in continued development within the greater sage-grouse range, resulting in habitat loss, fragmentation, direct and indirect disturbance. Development results in sage-grouse population declines.

Conservation Objective: Energy development should be designed to ensure that it will not impinge upon stable or increasing sage-grouse population trends.

Addressing energy development and any subsequent successful restoration activities in sagebrush ecosystems will require consideration of local ecological conditions, which cannot be prescribed on a range-wide level. Where state sage-grouse management plans have already identified an effective strategy for energy development that meets the above objective, the strategies in those plans should be implemented. In all other situations, the following measures should be considered to avoid, reduce, or mitigate impacts from energy development.

Conservation Measures:

1. Avoid energy development in PACs (Doherty *et al*. 2010). Identify areas where leasing is not acceptable, or not acceptable without stipulations for surface occupancy that maintains sage-grouse habitats.
2. If avoidance is not possible within PACs due to pre-existing valid rights, adjacent development, or split estate issues, development should only occur in non-habitat areas, including all appurtenant structures, with an adequate buffer that is sufficient to preclude impacts to sage-grouse habitat from noise, and other human activities.
3. If development must occur in sage-grouse habitats due to existing rights and lack of reasonable alternative avoidance measures, the development should occur in the least suitable habitat for sage-grouse and be designed to ensure at a minimum that there are

no detectable declines in sage-grouse population trends (and seek increases if possible) by implementing the following:

a. Reduce and maintain the density of energy structures below which there are not impacts to the function of the sage-grouse habitats (as measured by no declines in sage-grouse use), or do not result in declines in sage-grouse populations within PACs.
b. Design development outside PACs to maintain populations within adjacent PACs and allow for connectivity among PACs.
c. Consolidate structures and infrastructure associated with energy development.
d. Reclamation of disturbance resulting from a proposed project should only be considered as mitigation for those impacts, not portrayed as minimization.
e. Design development to minimize tall structures (turbines, powerlines), or other features associated with the development (e.g., noise from drilling or ongoing operations; Blickley *et al*. 2012).

<u>Sagebrush Removal</u>

The intentional removal or treatment of sagebrush (using prescribed fire, or any mechanical and chemical tools to remove or alter the successional status of the sagebrush ecosystem) contributes to habitat loss and fragmentation, a primary factor in the decline of sage-grouse populations. Removal and manipulation of sagebrush may also increase the opportunities for the incursion of invasive annual grasses, particularly if the soil crust is disturbed (Beck *et al*. 2012). Although many treatments are often presented as improving sage-grouse habitats, data supporting the positive impacts of sagebrush manipulation on sage-grouse populations is limited (Beck *et al*. 2012).

Conservation Objective: Avoid sagebrush removal or manipulation in sage-grouse breeding or wintering habitats.

Exceptions to this can be considered where minor habitat losses are sustained while implementing other habitat improvement or maintenance efforts (e.g., juniper removal) and in areas used as late summer brood habitat (Connelly *et al*. 2000). Appropriate regulatory and incentive-based mechanisms must be implemented to preclude sagebrush removal and manipulation for all other purposes.

<u>Grazing</u>

Livestock grazing is the most widespread type of land use across the sagebrush biome (Connelly *et al*. 2004) and almost all sagebrush areas are managed for livestock grazing (Knick *et al*. 2003). Improper livestock management, as determined by local ecological conditions, may have negative impacts on sage-grouse seasonal habitats (75 FR 13910 and references therein), and management to enhance populations of wild ungulates may also have negative impacts (e.g. removal of sagebrush overstory in an attempt to increase forage production for wild ungulates).

Conservation Objective: Conduct grazing management for all ungulates in a manner consistent with local ecological conditions that maintains or restores healthy sagebrush shrub and native perennial grass and forb communities and conserves the essential habitat components for sage-grouse (e.g. shrub cover, nesting cover). Areas which do not currently meet this standard should be managed to restore these components. Adequate monitoring of grazing strategies and their results, with necessary changes in strategies, is essential to ensuring that desired ecological conditions and sage-grouse response are achieved.

Achieving the above objective will require the development of long-term strategies that provide seasonal habitats for sage-grouse. Although grazing management should initially focus on retaining the above habitat conditions within PACs, sound grazing management should be applied across all sagebrush habitats. Grazing management strategies must consider the local ecological conditions, including soil types, precipitation zones, vegetation composition and drought conditions. Livestock and wild ungulate numbers must be managed at levels that allow native sagebrush vegetative communities to minimally achieve Proper Functioning Conditions (PFC; for riparian areas) or Rangeland Health Standards (RHS; uplands). Similar measures should be implemented on non-federal land surfaces.

There are several potentially useful tools for developing management strategies (such as Ecological Site Descriptions (ESDs) and PFC metrics. However, use of these tools must be tied to sage-grouse habitat and population parameters if they are to be considered as a sole measure for monitoring condition and, if appropriate, rehabilitation progress (Doherty *et al.* 2011). ESDs are not available across the entire range. Given the utility of ESDs in developing local management strategies, ESDs should be completed throughout the entire range of sage-grouse.

Implementation of the following options could help reduce any threats that grazing may pose to sage-grouse.

Conservation Options:

1. Ensure that allotments meet ecological potential and wildlife habitat requirements; and, ensure that the health and diversity of the native perennial grass community is consistent with the ecological site.
2. Inform and educate affected grazing permittees regarding sage-grouse habitat needs and conservation measures.
3. Incorporate sage-grouse habitat needs or habitat characteristics into relevant resource and allotment management plans, including the desired conditions with the understanding that these desired conditions may not be fully achievable: (a) due to the existing ecological condition, ecological potential or the existing vegetation; or (b) due to causal events unrelated to existing livestock grazing.
4. Conduct habitat assessments and, where necessary, determine factors causing any failure to achieve the habitat characteristics. Make adjustments as appropriate.

5. Given limited agency resources, priority should be given to PACs and then sage-grouse habitats adjacent to PACs.

Range Management Structures

Structures which support range management activities can have negative impacts on sage-grouse habitats by increasing fragmentation (e.g., fences and roads) or diminishing habitat quality (e.g., concentrating ungulates in winter habitats). Typical range management structures include fences, water developments and mineral licks. As fences can be both a positive and negative impact on sage-grouse and their habitats, depending on their location and use, they are addressed in a separate section below.

Conservation Objective: Avoid or reduce the impact of range management structures on sage-grouse.

Conservation Measures:

1. Range management structures should be designed and placed to be neutral or beneficial to sage-grouse.
2. Structures that are currently contributing to negative impacts to either sage-grouse or their habitats should be removed or modified to remove the threat.

Free-Roaming Equid Management

Free-roaming equid grazing is presented separately from ungulate grazing due to the differing impacts equids have on sagebrush ecosystems. On a per capita body mass, horses consume more forage than cattle or sheep and remove more of the plant which limits and/or delays vegetative recovery (Menard *et al*. 2002), and horses can range further between water sources than cattle, thereby making them more difficult to manage. Equid grazing results in a reduction of shrub cover and more fragmented shrub canopies, which can negatively affect sage-grouse habitat (Beever and Aldridge 2011). Additionally, sites grazed by free-roaming equids have a greater abundance of annual invasive grasses, reduced native plant diversity and reduced grass density (Beever and Aldridge 2011). Given the high mobility of free-roaming equids, the conservation measures below should be applied across all sage-grouse habitats.

Conservation Objective: Protect sage-grouse from the negative influences of grazing by free-roaming equids.

Conservation Measures

1. Develop, implement, and enforce adequate regulatory mechanisms to protect sage-grouse habitat from negative influences of grazing by free-roaming equids.

2. Manage free-roaming equids at levels that allow native sagebrush vegetative communities to minimally achieve PFC (for riparian areas) or RHS (for uplands). Similar measures should be implemented on non-federal land surfaces.

Conservation Options

1. Determine if the current appropriate management levels (AMLs) maintain suitable sage-grouse habitat parameters. Support additional research to quantitatively determine impacts of wild horses and burros on sage-grouse habitat parameters.
2. Until research on AMLs is completed, manage for AMLs within horse management areas on federal lands. Current AMLs should be adjusted for drought conditions.
3. Develop scientific procedures that can be replicated to count horses so that proper management actions can be implemented when numbers exceed AMLs.
4. Develop a sound monitoring program with prescriptive management "triggers" to make adjustments in horse and burro numbers or their distribution, as necessary.

<u>Pinyon-juniper Expansion</u>

Greater sage-grouse are negatively impacted by the expansion of pinyon and/or juniper in their habitats, even if the underlying sagebrush habitats remain (Freese *et al.* 2009). Sage-grouse avoid these areas of expansion (Casazza *et al.* 2010), and as the pinyon and/or juniper increases in abundance and size, the underlying habitat quality for sage-grouse diminishes.

Conservation Objective: Remove pinyon-juniper from areas of sagebrush that are most likely to support sage-grouse (post-removal) at a rate that is at least equal to the rate of pinyon-juniper incursion.

Treatments to remove pinyon and/or juniper trees in phase 1 (trees present but shrubs and herbs are the dominant vegetation that influence ecological processes) and phase 2 (tress are co-dominant with shrubs and herbs and all three vegetation layers influence ecological processes; Miller *et al.* 2008) state of incursion should match the rate of incursion (minimally 200,000 acres per year; Stiver *et al.* 2006). Removal should be prioritized by seasonal habitats, based on the habitat that is locally limiting populations. Removal techniques should not include prescribed fire in low elevation, xeric sagebrush communities.

Pinyon and/or juniper removal activities should focus initially on areas within PACs, but all opportunities to remove this threat should be considered if resources are available. Where state sage-grouse management plans provide an effective strategy for pinyon-juniper, those strategies should be implemented. In all other situations the following conservation options should be considered.

Conservation Options:

1. Prioritize the use of mechanical treatments for removing pinyon and/or juniper. These techniques allow for more selective removal of invading plants, and more importantly allows understory habitats to remain intact.
2. Use caution when planning use of prescribed fire in high elevation mountain big sage sites to prevent fire escape and any subsequent establishment of invasive annual grasses or other weeds.
3. Reduce juniper cover in sage-grouse habitats to less than 5% (Freese 2009, Cassaza *et al*. 2010), but preferably eliminate entirely.
4. Employ all necessary management actions to maintain the benefit of pinyon and/or juniper removal for sage-grouse habitats, including long-term monitoring (greater than 30 years) with appropriate management responses should the resultant habitat quality decline.

Agricultural Conversion

Agricultural conversion is typically defined as the conversion of sagebrush habitats to tilled agricultural crops or re-seeded exotic grass pastures, resulting in habitat loss and fragmentation. Agricultural conversion can also be the conversion of conservation (e.g., those enrolled in the Conservation Reserve Program (CRP) or State Acres for Wildlife Enhancement (SAFE)) when such lands are providing important habitat components for sage-grouse. This type of conversion could be detrimental to sage-grouse in areas where the birds depend on these interim successional habitats (such as in Washington).

Conservation Objective: Avoid further loss of sagebrush habitat for agricultural activities (both plant and animal production) and prioritize restoration. In areas where taking agricultural lands out of production has benefited sage-grouse, the programs supporting these actions should be targeted and continued (e.g. CRP/SAFE). Threat amelioration activities should, at a minimum, be prioritized within PACs, but should be considered in all sage-grouse habitats.

Conservation Options:

1. Revise Farm Bill policies and commodity programs that facilitate ongoing conversion of native habitats to marginal croplands (e.g., through the addition of a 'Sodsaver' provision), to support conservation of remaining sagebrush-steppe habitats.
2. Continue and expand incentive programs that encourage the maintenance of sagebrush habitats.
3. Develop criteria for set-aside programs which stop negative habitat impacts and promote the quality and quantity sage-grouse habitat.
4. If lands that provide seasonal habitats for sage-grouse are taken out of a voluntary program, such as CRP or SAFE, precautions should be taken to ensure withdrawal of the lands minimizes the risk of direct take of sage-grouse (e.g., timing to avoid

nesting season). Voluntary incentives should be implemented to increase the amount of sage-grouse habitats enrolled in these programs.

Mining

Surface mining and appurtenant facilities within sage-grouse habitats result in the direct loss of habitat, habitat fragmentation, and indirect impacts from disturbance (e.g., noise, dust). Current reclamation activities do not always consider sage-grouse habitat needs. Those that do may take decades to restore habitats and experience the same limitations as restoration activities. Surface facilities supporting underground mining activities can have similar impacts.

Conservation Objective: Maintain stable to increasing sage-grouse populations and no net loss of sage-grouse habitats in areas affected by mining.

Reclamation of mined lands within sage-grouse habitats should be focused on restoring habitats usable by sage-grouse, and the re-establishment of sage-grouse in these areas. Where state sage-grouse management plans provide effective conservation strategies for mining those strategies should be implemented. In all other situations the following conservation options should be considered.

Conservation Options:

1. Avoid new mining activities and/or any associated facilities within occupied habitats, including seasonal habitats;
2. Avoid leasing in sage-grouse habitats until other suitable habitats can be restored to habitats used by sage-grouse;
3. Reclamation plans should focus on restoring areas disturbed by mining and associated facilities to healthy sagebrush ecosystems, including evidence of use by sage-grouse.
4. Reclamation of abandoned mine lands should focus on restoring areas to healthy sagebrush ecosystems where possible.

Recreation

Recreational activities within sage-grouse habitats can result in habitat loss and fragmentation (e.g., creation of off-road trails, camping facilities) and both direct and indirect disturbance to the birds (e.g., noise, disruptive lek viewing, hunting dog trials, and dispersed camping).

Conservation Objective: In areas subjected to recreational activities, maintain healthy native sagebrush communities based on local ecological conditions and with consideration of drought conditions, and manage direct and indirect human disturbance (including noise) to avoid interruption of normal sage-grouse behavior.

Threat amelioration for recreation should be implemented in PACs, but considered in all sage-grouse habitats. Where state sage-grouse management plans provide an effective strategy for recreational activities, those strategies should be implemented. In all other situations the following conservation options should be considered.

Conservation Options:

1. Close important sage-grouse use areas to off-road vehicle use.
2. Avoid development of recreational facilities (e.g., new roads and trails, campgrounds) in sage-grouse habitats.

Ex-Urban Development

Ex-urban development (dispersed homes on small acreages) results in direct habitat loss, habitat fragmentation, and the introduction of invasive plant species. Urban and exurban activities also increase the presence of predator subsidies (e.g., trash, landfills, bird feeders) allowing for increased predators associated with humans that may have disproportionate impacts on greater sage-grouse (e.g., red fox, skunks, raccoons). Additionally, pets may have negative impacts on sage-grouse through direct predation or disturbance (e.g., chasing birds). Infrastructure associated with exurban development (e.g., powerlines, roads) also results in habitat loss and fragmentation, subsidies for avian predators such as ravens, and possible disturbance to sage-grouse. Moreover, concentration of hobby livestock on small acreages can result in habitat loss and the introduction of invasive annual grasses and weeds.

Conservation Objective: Limit urban and exurban development in sage-grouse habitats and maintain intact native sagebrush plant communities.

At a minimum, threat amelioration for ex-urban development should occur within PACs, but should also be considered in all sage-grouse habitats. Where state sage-grouse management plans provide an effective strategy for managing ex-urban development, they should be implemented. In all other situations the following conservation options should be considered.

Conservation Options:

1. Provide incentives to maintaining large tracts of private lands that provide habitat for sage-grouse. These incentives can include (but may not be limited to):
   a. Developing habitat conservation plans;
   b. Conservation easements or leases; and/or
   c. Land swaps.
2. Acquire and manage sage-grouse habitat to maintain intact ecosystems.
3. Consolidate infrastructure that supports urban and exurban development.
4. Do not allow landfills in sage-grouse habitats, or within 5 km of sage-grouse habitats.

5. Do not relinquish public lands for the purpose of urban development in sage-grouse habitat.

Infrastructure

Development of infrastructure for any purpose (e.g., roads, pipelines, powerlines, and cellular towers) results in habitat loss, fragmentation, and may cause sage-grouse habitat avoidance. Additionally, infrastructure can provide sources for the introduction of invasive plant species and predators.

Conservation Objective: Avoid development of infrastructure within PACs.

Conservation Measures:

There should be no new development of infrastructure corridors within PACs. Designated, but not yet developed infrastructure corridors should be re-located outside of PACs unless it can be demonstrated that these corridors will have no impacts on the maintenance of neutral or positive sage-grouse population trends and habitats. New infrastructure should be avoided where individual state plans have identified key connectivity corridors outside of PACs.

Where state sage-grouse management plans provide an effective strategy for infrastructure those strategies should be implemented. In all other situations the following conservation options should be considered.

Conservation Options:

1. Avoid construction of these features in sage-grouse habitat, both within and outside of PACs.
2. Power transmission corridors which cannot avoid PACs should be buried (if technically feasible) and disturbed habitat should be restored.
    a. If avoidance is not possible, consolidate new structures with existing features and/or preclude development of new structures within locally important sage-grouse habitats.
        i. Consolidation with existing features should not result in a cumulative corridor width of greater than 200m.
        ii. Habitat function lost from placement of infrastructure should be replaced.
3. Infrastructure corridors should be designed and maintained to preclude introduction of invasive plant species.
4. Restrictions limiting use of roads should be enforced.
5. Remove transmission lines and roads that are duplicative or are not functional.

6. Transmission line towers should be constructed to severely reduce or eliminate nesting and perching by avian predators, most notably ravens, thereby reducing anthropogenic subsidies to those species.
7. Avoid installation of compressor stations in PACs or other sage-grouse habitats where sage-grouse would be affected by noise and operation activities.
8. All commercial pipelines should be buried and habitat that is disturbed needs to be reclaimed with current and future emphasis placed on suppression of non-native invasive plant species.
9. Mitigate impacts to habitat from development of these features.
10. Remove (or decommission) non-designated roads within sagebrush habitats.

Fences

Fences can be deleterious to sage-grouse populations and habitats, with threats including habitat fragmentation and direct mortality through strikes (Stevens *et al.* 2012). Fences can improve habitat conditions for sage-grouse (e.g. by protecting riparian areas providing brood-rearing habitats from overgrazing). The assessment of the impact or benefit of fences must be made considering local ecological conditions and the movement of sage-grouse within local areas (Stevens *et al*. 2012).

Conservation Objective: Minimize the impact of fences on sage-grouse populations.

Conservation Options:

1. Mark fences that are in high risk areas for collision (Stevens *et al.* 2012) with permanent flagging or other suitable device to reduce sage-grouse collisions on flat to gently rolling terrain in areas of moderate to high fence densities (i.e., more than 1 km of fence per km^2) located within 2 kms of occupied leks.
2. Identify and remove unnecessary fences.
3. Placement of new fences and livestock management facilities (including corrals, loading facilities, water tanks and windmills) should consider their impact on sage-grouse and, to the extent practicable, be placed at least 1 km from occupied leks (Stevens *et al*. 2012).

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APPENDIX A—MANAGEMENT ZONE AND POPULATION RISK ASSESSMENTS

See Figure 3 for a map of management zones and populations.

MANAGEMENT ZONE I: GREAT PLAINS

This management zone consists of four sage-grouse populations as identified by Garton *et al*. (2011), including the Dakotas, Northern Montana, Powder River Basin, and Yellowstone Watershed populations. All of these populations cross state or provincial boundaries. Garton *et al.* (2011) predicted an 11.1 percent chance this Management Zone will fall below 200 males by 2037, and a 24.0 percent chance it would fall below 200 males by 2107. Privately-owned lands are a major constituent of sagebrush landscapes in the Great Plains (66 percent), followed by BLM (17 percent), and then other ownerships (Knick 2011). After Management Zones II and IV, this zone contains some of the most connected networks of sage-grouse leks in the range (Knick and Hanser 2011). On the other hand, sagebrush habitat in 37 percent of this zone is 75-100 percent similar to sagebrush habitat in areas where extirpation has occurred (Wisdom *et al.* 2011). Generally, areas in this zone that are least similar to extirpated parts of the range include the western portions of Northern Montana and Powder River populations and the southeast corner of the Yellowstone Watershed population (Wisdom *et al*. 2011, Figure 18.5).

Dakotas

The Dakotas's population occurs on the far eastern edge of the range of sage-grouse. Much of the population occurs in the Cedar Creek Anticline. Garton *et al*. (2011) reported the minimum male count for this population at 587 and predicted a 66 percent chance that this population would dip below 200 males in the next 100 years. Population counts in 2012 for North and South Dakota were approximately 300, so this population as a whole very likely still exceeds 500 birds. Priority areas for conservation (PACs) in North and South Dakota are connected by general habitat consisting of limited sagebrush habitat. Sage-grouse movements generally occur east and west between the Dakotas's population and Montana. Connectivity between the sub-populations occurs through Montana's portion of the population (Knick and Hanser 2011). This area was identified as a PAC in Montana due to historically high density of sage-grouse and for the seasonal habitat it provides for birds from North Dakota, a likely conduit for genetic connectivity. The area is heavily influenced by oil and gas development and conversion of native rangeland to cropland is a major threat to the persistence of this sage-grouse population. Over-grazing in localized areas has degraded the sagebrush habitat and can reduce nesting success. Nesting success was positively correlated to grass cover in North Dakota (Herman-Brunson 2007). Overall, this population is small and at high risk.

Northern Montana

The Northern Montana Population is predominantly in northeast Montana but extends north into southern Saskatchewan and Alberta, making up these provinces' entire sage-grouse populations. Garton *et al*. (2011) reported a minimum male count for this population at over 2,700 males and projected a very low probability (i.e., two percent) of the population dipping below 200 males in the next 100 years. The southern portion of this area, south of the Milk River, has a high abundance of sage-grouse, has been designated as a PAC, and is predominately comprised of public land. Land use in this area is livestock grazing with limited dryland farming and irrigated hay production adjacent to creeks and rivers. In general, habitat in this PAC is expansive and intact and faces few if any significant threats, particularly on public lands. Grouse in this PAC make up the majority of birds in this population. North of the Milk River, habitats comprise a relatively low density of silver sagebrush and a correspondingly low density of sage-grouse. The sage-grouse habitats in this area include more private lands and, in some portions of this area, have a long history of grain farming and low to moderate densities of natural gas production. A PAC was designated in northern Valley County where relatively intact habitats provide for resident grouse as well as a conduit for spring and fall migrating sage-grouse between Saskatchewan and southern Valley County. This PAC is adjacent to considerable farming to the east but is itself relatively stable and lacks significant threats. One or more large conservation easements are in place to protect habitat values on key private lands in northern Valley County. Given the extent and limited threats associated with this population, it is considered to be at low risk.

Powder River Basin

The Powder River Basin occurs mostly in Northeast Wyoming, but an area in southern Montana comprises the extreme northern tip of this population. A recent sagebrush cover assessment estimated average cover of sagebrush in the Powder River Basin to be 35 percent, with an average sagebrush patch size less than 300 acres (Rowland *et al.* 2005). Sagebrush patch size in the Powder River Basin has decreased by more than 63 percent in 40 years, down from 820 acre patches and an overall coverage of 41 percent in 1964. Most of the occupied sage-grouse habitat in northeast Wyoming is privately owned. Approximately 70 percent of known leks are found on private land; the remaining 30 percent are found on FS, BLM, and state lands (Northeast Wyoming Sage-grouse Working Group 2006).

Garton *et al*. (2011) reported a minimum male count for this population at 3,042 and projected a high probability (86.2 percent) of falling below 200 males by 2107. A recent viability study done for BLM (Taylor *et al.* 2012) indicates that sage-grouse viability in the Powder River Basin is being impacted by multiple stressors including West Nile virus and energy development. Their results suggest that if development continues, future viability of the already small sage-grouse populations in northeast Wyoming will be compromised. The Powder River Basin holds vast energy resources including oil, natural gas, and coal bed natural gas (Northeast Wyoming Sage-grouse Working Group 2006). The state has a core area management strategy to help balance the priorities of retaining healthy sage-grouse population on the landscape and energy development.

Although the Montana piece of the Powder River Basin makes up a relatively small portion of the population, it may provide genetic connectivity with other Montana populations. Land use in Montana's portion of this population includes a mix of livestock grazing, coal mining, and shallow coal bed natural gas production. Montana identified relatively small but intact habitats that have limited energy development and may serve as remnant habitat for supporting small numbers of sage-grouse into the future. The expanding threat of energy development across the Powder River Basin and corresponding downward population index trend makes this overall an at-risk population.

Yellowstone Watershed

The Yellowstone Watershed Population is a large population covering an expansive area south of the Missouri River, making up the majority of sage-grouse habitats in southeast and south central Montana. Garton *et al.* (2011) reported a minimum male count of over 2,900 males. They further projected a 60 percent chance of this population dipping below 200 males in the next 100 years. Landownership is predominantly private with scattered tracts and blocks of public land. Livestock grazing and small grain farming are common in this area. Oil and gas developments are scattered across portions of this area. Extensive private lands have the potential for conversion of additional sagebrush habitats to farming and various forms of sagebrush eradication. Cropland conversion continues to take place in this area. Priority areas for conservation have been identified both in the western and southeastern portions of this population, where sage-grouse densities are greatest and habitats remain relatively intact. The western and southeastern PACs are separated by about 70 miles of a mix of habitats, including an interstate highway, the Yellowstone river corridor, and a patchwork of cropland intermingled with occupied sage-grouse habitat. Some portion of this space between PACs may be identified as a PAC in the future as movement corridors and habitats needed for population connectivity become better understood and defined. Overall this population is only potentially at-risk.

MANAGEMENT ZONE II: WYOMING BASIN

This management zone is made up of five sage-grouse populations as identified by Garton *et al.* (2011), including Jackson Hole, Laramie, Eagle-South Routt, Middle Park, and the Wyoming Basin. Colorado and Utah's portions of the Wyoming Basin are described separately as the NWCO and North Park subpopulations in Colorado, and the Rich-Summit-Morgan and Uintah Management Areas in Utah. This management zone represents the highest abundance of sage-grouse relative to other management zones across the sage-grouse's range. Garton *et al.* (2011) predicted a small, 0.3 percent chance, that this zone will fall below 200 males by 2037, and a 16.2 percent chance it would fall below 200 males by 2107. The majority of this management zone is represented by the Wyoming Basin population. Montana's portion of the zone is very small, only including the northern tip of the Wyoming Basin population in a portion of Carbon

County. BLM and privately-owned lands are major constituents of sagebrush landscapes in this zone, representing 49 percent and 35 percent of the ownership, respectively (Knick 2011). Management Zone II contains the most highly connected network of sage-grouse leks in the range (Knick and Hanser 2011). This zone is also a stronghold for sage-grouse because it contains the second largest area of habitat range-wide (and the largest in the eastern range) with low similarity to extirpated portions of the range (Wisdom *et al*. 2011).

The Colorado portion of this management zone appears to capture redundancy and representation in the PACs. Priority areas for conservation represent 61 percent of the occupied range in Colorado and 84 percent of the breeding birds in the state (CPW 2012). Being on the edge of the species' range, the Colorado populations within this management zone are somewhat isolated. Linkage zones have been mapped among the Colorado populations and subpopulations (i.e., Eagle-South Routt, Middle Park, North Park, and NWCO) (CPW 2012). It is assumed the habitat linkages will allow for movement between populations and will decrease the probability of extinction of the subpopulations by stabilizing population dynamics. Connectivity between Wyoming's and Colorado's PACs may be adequate in most areas, but there may be some areas to address in the northwest Colorado area.

Eagle-South Routt

This population occurs in north-central Colorado and is separated from nearby populations by distance and mountainous terrain (Garton *et al.* 2011). The Eagle-South Routt population adds to representation and redundancy within Management Zone II because of its location on the landscape and limited connectivity to other populations within this zone. Priority areas for conservation capture 68 percent of the occupied range in this population and include 100 percent of all known active leks. These areas also contain all habitats that were modeled "high probability of use" within four miles of leks that have been active in the last 10 years (CPW 2012). Redundancy is not captured within this population because it is a fairly isolated population that is also fairly small (the three year average number of males from 2010-2012 is 108). Populations (in terms of males only) in the late 1960s were likely in the high 200s (CGSSC 2008). The greatest threat to this population is loss of habitat from subdivision and housing development as well as the associated infrastructure and roads (CPW 2008; NWCOCP 2008). Pinyon-juniper encroachment has been, and continues to be, a significant threat to the population as well. This population is high risk because, given its smaller population size and isolation, a stochastic event could greatly negatively affect this population.

Middle Park

The Middle Park population occurs east of Eagle-South Routt in north-central Colorado and is separated from adjacent populations by distance and mountainous terrain (Garton *et al.* 2011). Representation and redundancy appear to be captured adequately in Middle Park. Priority areas for conservation capture 79 percent of the occupied range in this population and also include 95 percent of all known active leks. Furthermore, PACs contain 95 percent of all habitats that were modeled "high probability of use." Redundancy is captured reasonably well within this population because, although it currently has a three-year running average of 210 males, the

PACs include most of the known distribution of birds. Connectivity to the North Park population has been documented. Housing development is the most current and foreseeable threat. Grand County has experienced a high rate of human population growth in recent years. This high human population growth rate is projected to continue primarily due to its' proximity to major ski resorts and summer recreational activities. Although this is a relatively small sage-grouse population, Colorado Parks and Wildlife (CPW) does not believe the population has ever been very large. Since the 1970's, the population counts have been roughly between 200 and 325 males. Connectivity to the North Park population has always been somewhat naturally limited over Muddy Pass although CPW has documented birds moving over the pass. Overall this population is considered at-risk.

Laramie

This population consists of five leks located southwest of Laramie, Wyoming. Few birds are seen on these leks although one is routinely occupied by a small number of birds, despite the fact that the running average of the number of males per lek was zero from 2004 to 2007 (WAFWA 2008). None of these leks are contained in a PCA and four of these leks are threatened by proposed wind energy development. Overall this population is considered high risk.

Jackson Hole

The Jackson Hole population is a small population located near Jackson Hole, Wyoming. This population is geographically isolated due to surrounding topography and limited habitat. This population consists of 16 leks (13 active and three inactive in past 10 years), of which only one is considered large (averaging over 40 birds). Population trend information indicates that this population is decreasing slightly, declining from an average of 20.5 males per active lek in 2005 to 14.9 males per active lek in 2011. Most of the breeding habitat in this population is contained within a single PAC. However there are three small subpopulations that are isolated from the main Jackson Hole PAC: Gros Ventre (two leks); Star Valley/State Line (two leks in Idaho) and Hoback Basin (one lek). Threats to this population consist of internal habitat fragmentation resulting from wildfires, prescribed burns, herbivory of sagebrush by elk and bison winter feeding operations, urban development, and recreational activities. Grand Teton National Park and the National Elk Refuge encompass most of the PACs and protect much of the crucial habitat. This population exists in high mountain valleys with deep snowpack and the amount of available winter habitat is a limiting factor based on studies by Holloran and Anderson (2004) and Bedrosian and Craighead (2010). Yellowstone National Park is just to the north, making Jackson Hole a popular tourist destination. Skiing and snowmobiling are prime recreational activities during winter. Urban development is limited as a result of limited private lands within this population, but includes some crucial winter habitat. Recently, energy development has begun in the southern edge of this population (Hoback Basin). Population estimates, based on male lek counts, indicate that total population numbers fluctuate, with a high of approximately 500 birds. Modeled population forecasts suggest that populations will decline, and long-term persistence is unlikely (Garton *et al.* 2011). Due to low population numbers, population isolation and a high degree of threats, this population is considered high risk.

Wyoming Basin

This large population extends into Montana, Idaho, Utah, and Colorado. The population is separated from adjacent populations by distance and topography (Garton *et al*. 2011). This population is the largest population within the species' range (> 20,000 males attending leks annually), and is very robust. However, long-term population trends are slightly downward, although recent counts suggest an increase. Even so, population modeling suggests that declines will continue over the long-term (Garton *et al*. 2011). This population is described in several smaller pieces, including the Wyoming portion (including the small piece that extends into Montana) of the population, Uintah and Rich-Morgan-Summit Management Areas in Utah, and North Park and NWCO subpopulations in Colorado.

Wyoming Portion

This large population covers approximately two-thirds of the State of Wyoming. It extends into Montana, Idaho, Utah and Colorado (Utah and Colorado portions are described separately). The population is separated from adjacent populations by distance and topography (Garton *et al.* 2011). Sage-grouse habitats are expansive and relatively intact outside of areas of energy development. Despite the long-term declines in populations, implementation of the Wyoming Governor's Executive Order for sage-grouse may help alleviate these declines. The primary threats to this portion of the population are energy development and transfer, including both renewable and non-renewable resources, long-term drought, and brush eradication programs. Declines of sage-grouse near oil and gas fields in this area have been well documented (Lyon 2000; Holloran 2005; Holloran and Anderson; Kaiser 2006). Residential development has also been identified as a threat. Recent conservation actions, including the Wyoming Governor's Executive Order designating protective stipulations for core areas (PACs) and the implementation of conservation easements within these areas have reduced the threat risk to this area. Designated state core areas (PACs) adequately capture redundancy and representation for the Wyoming portion of this population. Due to the large size of this population, the presence of large, contiguous habitats, and regulatory measures providing habitat protection, this population is considered low risk.

The majority of habitat that supports the Montana portion of the Wyoming Basin population is identified as a PAC, both because of the relatively high density of sage-grouse in the area and the likely role this area plays connecting Montana's sage-grouse to Wyoming's birds. In Montana, this area is among the driest of sage-grouse habitats and has a higher prevalence of cheat-grass relative to other parts of Montana. Land use includes livestock grazing and a long history of oil limited production. This portion of the Wyoming Basin Population is relatively small but is within 20 miles of another core area in Wyoming.

Rich-Morgan-Summit

The Rich-Morgan-Summit Sage-grouse Management Area is located in Northeastern Utah, and is a part of the Wyoming Basin population, a significant population center for grouse in Utah, Idaho, Colorado, and Wyoming. This management area also includes part of what is mapped in Garton *et al*. 2011 as Summit-Morgan Counties in Management Zone III. The area boundary was determined by consulting with adjacent states, Utah Division of Wildlife Resources, the Morgan-Summit Adaptive Resources Management Local Sage-grouse Working Group, and the Rich County Coordinated Resource Management Sage-grouse Local Working Group and follows vegetation types usable by sage-grouse. This portion of the population is regarded as stable with potential for growth. Based on a ten-year average count of males on leks, the area had an estimated 1,223 males as of 2011. Sage-grouse in this area show resiliency to known threats. Key threats to sage-grouse include invasive species, loss of agricultural operations, predation, residential development, and habitat fragmentation through recreational development. In conjunction with populations in Wyoming, the management area is considered low risk.

Uintah

The Uintah Sage-grouse Management Area is located in northeastern Utah. This management area had an estimated 452 males on leks as of 2011. Within the northern portion of this area is the Diamond Mountain and Browns Park population, a significant population center for sage-grouse in Utah, Colorado, and Wyoming. The central and southern portions of the management area contain fragmented populations with minimal connectivity and low potential for habitat improvement. The Management Area boundary was determined by consulting with Utah Division of Wildlife Resources and the Uinta Basin Adaptive Resource Management Local Working Group, and follows vegetation types usable by sage-grouse. This portion of the Wyoming Basin population is regarded as stable with a potential for growth and also has strong connectivity with other portions of the population. Sage-grouse in the Management Area show resiliency to known threats. Key threats to sage-grouse include predation, wildfire, invasive species, noxious weeds, disease, loss of agricultural operations, and habitat fragmentation (naturally occurring, but not topographical, and from existing and future anthropogenic uses). In concert with the remaining portions of this population, the management area is considered low risk.

North Park

This portion of the Wyoming Basin population is located in North Park, Jackson County, Colorado. In North Park (NP), representation and redundancy appear to be captured well. Priority areas for conservation capture 91 percent of the occupied range in this population and include 100 percent of all known active leks and 100 percent of habitat that was modeled "high probability of use" within 4 miles of a lek that has been active within the last 10 years. Historically, no significant threats were apparent to this population. However, there is renewed interest in oil development in the area. In addition, a large portion (29 percent) of public land in PACs has been leased for energy development. North Park has overlapping energy and mineral resources and thus could experience natural gas, coal bed methane, and oil extraction. Although present, the other identified threats are less than other portions of the population. The habitat within PACs is in fairly good condition, and a large portion is on public lands. This is likely Colorado's most resilient area of occupied sage-grouse habitat. Long -term data trends (since the early 1970's) indicate this population has fluctuated roughly between 500 and 1,500 males. This subpopulation is considered low risk.

Northwest Colorado

In the northwest Colorado portion of this population, representation and redundancy appear to be captured adequately. Priority areas for conservation capture 56 percent of the occupied range and also include 95 percent of all known active leks and 95 percent of habitat that was modeled "high probability of use" within 4 miles of a lek that has been active within the last 10 years. Most of the sub-management zones within this portion of the population have some connectivity with other portions of this population. This is Colorado's largest area of sage-grouse occupancy and is considered to be at low risk of extirpation. The northern portion is likely to be more resilient than the southeastern portions of this population because of habitat condition and connectivity. There is more habitat fragmentation in the southeastern portion of this population. According to lek count data, the long-term trend appears to be stable, despite substantial fluctuations. Population peaks have occurred in 1960-70, 1978-80, and in the mid-2000s.

MANAGEMENT ZONE III: SOUTHERN GREAT BASIN

This management zone includes populations in California, Nevada, and Utah. The California populations in this Management Zone are described separately in the Bi-State DPS section (see below) and the Summit Morgan Counties population is described in Management Zone II. The populations in this management zone include Southern Great Basin, Northeast Interior, Sheeprock, Quinn Canyon Range, South Central Utah, Northeast Interior Utah, Emery, and Northwest Interior. Garton *et al*. (2011) predicted a 0.0 percent chance this Management Zone will fall below 200 males by 2037, and a 7.8 percent chance it would fall below 200 males by 2107. Landownership in this zone is predominately BLM (71 percent), followed by private (13 percent) and others (Knick 2011). This zone is part of a stronghold for sage-grouse (that includes Management Zones III, IV, and V) because the three zones contain the largest area of habitat range-wide with low similarity to extirpated portions of the range (Wisdom *et al*. 2011). Despite the fact this zone has large areas of sagebrush habitat in Nevada this area faces large risks due to wildfire. Since it is difficult to restore burned habitat (Pyke 2011), the management approach for this area should provide a cushion to deal with fire events that are expected to occur but are not predictable in their location, extent, and outcome.

Northeast Interior Utah

This population is located entirely in Utah and has been divided into the Strawberry Valley and Carbon Management Areas.

Strawberry Valley

The Strawberry Valley Sage-grouse Management Area is located in central Utah, and is a significant population center for sage-grouse in Utah. This management area had an estimated 82 males on leks as of 2011. The area boundary was determined by consulting with DWR and the Strawberry Valley Adaptive Resource Management Local Working Group, and follows vegetation types usable by sage-grouse. Significant restoration efforts have been conducted on this population and it is the most intensively managed in Utah. This population is regarded as stable with a high potential for growth. Sage-grouse in this area had suffered significant reductions in populations, but concentrated restoration efforts have resulted in significant population growth. Due to its smaller size, Strawberry Valley is considered at-risk.

Carbon

The Carbon Sage-grouse Management Area is located in the northern portion of the Colorado Plateau in central Utah. This management area had an estimated 119 males on leks as of 2011. The area is characterized by highly broken terrain, with deep canyons and mid-elevation plateaus. Telemetry studies in the area suggest that occasionally sage-grouse migrate to and from the adjoining Strawberry Valley portion of this population. The area boundary was determined by buffering active leks with topographic imagery, and adding areas of known winter use. Key threats include habitat loss and fragmentation due to a variety of factors including energy development, wildfire, invasive species, and predation. West Nile Virus has been reported in Carbon in the last 10 years. The management area is at-risk.

Emery

The Emery population in Utah is considered the Emery Sage-grouse Management Area and is also known as the Sanpete-Emery Counties population in Garton *et al.* (2011). This population had an estimated 30 males on leks as of 2011. Small, mostly isolated sage-grouse populations occupy high elevation sagebrush steppe on the eastern slope of the Wastach Plateau. Although no direct movement between these areas has been documented, this population is relatively close to the South Central Utah population (Parker Mountain portion). This population includes all currently used habitat and corridors connecting this habitat. Key threats to the population include woody species encroachment, wildfire, invasive species, predation, and habitat fragmentation. Due to its smaller size, Emery is considered at-risk.

Sheeprock

The Sheeprock population in Utah is a relatively isolated population center also known as the Sheeprock Mountains Management Area. Garton *et al.* (2011) refers to this as the Toole-Juab Counties population. This population had an estimated 102 males on leks as of 2011. The area boundary was determined by consulting with the West Desert Adaptive Resource Management local working group and Utah Division of Wildlife Resources, and follows vegetation types usable by sage-grouse. This population is regarded as stable with a potential for growth. Sage-grouse in this area show resiliency to known threats. Key threats to sage-grouse include wildfire, invasive species (cheatgrass and knapweeds), potential loss of riparian areas due to water piping, predation, and habitat fragmentation (dispersed recreation and pinyon-juniper encroachment). The management area is considered high risk.

South Central Utah

The population is located entirely within Utah and is one of the State's largest. It has been divided into three portions for management purposes including the Greater Parker Mountain, Panguitch, and Bald Hills.

Greater Parker Mountain

The Greater Parker Mountain Sage-grouse Management Area portion of the South Central Utah population is located on the Awapa Plateau and nearby environments. The Greater Parker Mountain Local Area Working Group was established in 1996 and is the longest operational working group in Utah. The boundaries of this portion of the population were refined based on 15 years of greater sage-grouse radio telemetry studies which included research on species' vital rates, survival, and seasonal movements. Boundary refinements included coordination with the working groups and the Utah Division of Wildlife Resources. This area had an estimated 821 males on leks in 2011. Because of these long-term research studies in this area, more is known about sage-grouse population dynamics, seasonal habitat use, population threats, and abatement strategies in this area than in other areas of Utah. This portion of the population includes all connected currently used habitats and corridors connecting these habitats. Key sage-grouse threats identified include: 1) loss or degradation of habitat (primarily due to vegetation succession), 2) conversion of habitat (sagebrush to pinyon-juniper or cheatgrass at the lower elevations), 3) increased risk of predation because of expansion of, or changes in, the native predator community in response to anthropogenic factors, and 4) habitat fragmentation from loss or degradation of habitat that results in a loss of sage-grouse habitat connectivity.

Panguitch

The Panguitch portion of the South Central Utah population is referred to as the Panguitch Management Area. It incorporates more than a dozen leks, often inter-connected. This area had an estimated 304 males on leks in 2011. This portion of the population is distributed north-south in a series of linked valleys and benches, and constrained by mountains and canyons. There is a large range in the number of males in attendance among these leks. Movement of sage-grouse from one valley or bench to another among seasons is necessary to meet their seasonal habitat requirements in the highly variable annual weather conditions of this region. This area has the highest potential for increase in Utah due to habitat treatments to remove pinyon-juniper. Key threats to sage-grouse in this area are increased predator populations, vegetation management (conflicting uses or lack of), energy development, and residential/commercial development.

Bald Hills

The Bald Hills portion of the South Central Utah population is referred to as the Bald Hills Management Area. This area had an estimated 68 males on leks in 2011. Currently, sage-grouse in the area are constrained by vegetation fragmentation and human development. However, future improvements could connect this population to the Southern Great Basin population (Hamlin Valley portion) to the west. This portion of the South Central Utah population is regarded as stable with a high potential for growth. Sage-grouse in this area show resiliency to known threats. Key threats include wildfire, increased predator populations, vegetation management (conflicting uses or lack of), and energy development.

Northwest Interior

This population is largely within Pershing County, Nevada, but also incorporates a portion of western Lander County and southeastern Humboldt County. Few PACs are mapped within this population other than some habitats within the Sonoma Range in southeastern Humboldt County, the Tobin Range in eastern Pershing County, and the Fish Creek Range in western Lander County. Priority areas for conservation identified within these ranges largely cover all remaining suitable habitat for sage-grouse. There were not enough data for Garton *et al.* (2011) to conduct an analysis on population trends or persistence estimates. The largest sub-populations within this area are within the Sonoma-Tobin complex and the Fish Creek Range. Lek count information from both of these areas suggest that there is less than 500 birds in each one of these populations and the potential for connectivity appears low, but possible. Other sub-populations within this area (e.g., Eugene Mountains, East Range, Humboldt Range, Majuba Mountain, and Trinity Ranges) have extremely low populations (<50 birds) with some of these ranges having populations that are extirpated due to severe wildfire and inability of the habitat to recover. Much of these areas are now monotypic stands of cheatgrass and tansy mustard. Overall, this population is high risk.

Southern Great Basin

This population contains the largest number of sage-grouse within Management Zone 3. It is relatively expansive and divided into a Nevada portion and Ibapah and Hamlin Valley portions within Utah.

Nevada

The Nevada portion of this population contains the largest number of sage-grouse in this population delineation. Suitable habitats are somewhat uncharacteristic of sage-grouse habitats because use areas are disjunct, but connected. This is due to the "basin and range" topography that is characteristic of this region. Lower elevation valley bottoms often are dominated by playas and salt desert shrub vegetation, but transcend quickly into sagebrush dominated benches, which often comprises the breeding and winter habitat. Moving up in elevation, pinyon-juniper woodlands dominate the mid-elevation and gives way to little sagebrush, mountain big sagebrush and mountain shrub communities used by sage-grouse as nesting and brood rearing habitat in the higher elevations (> 2,200 m).

Priority areas for conservation (PACs) adequately capture important use areas for this population as all use areas were mapped to the greatest extent practical under the time constraints given to complete a map for the BLM's interim guidance. Redundancy and representation exist within this population, largely because it covers a large geographic area. Most populations appear to be connected as indicated through recent telemetry investigations and the availability of suitable habitat between sub-populations within this region. Resiliency of the habitat is in question due to threats, either projected or realized, in the lower elevation habitats, as explained below.

Garton *et al*. (2011) determined that this population has declined by 19 percent from the period 1965-69 through 2000-2007 and that average rates of population change were <1.0 for three of the eight analysis periods from 1965-2007. In addition, Garton *et al.* (2011) determined that this population has a two percent chance of declining below 200 males within the next 30 years and a 78 percent chance of declining below 200 males within 100 years (by 2107).

Some of the historic habitat available to sage-grouse within this population has transitioned to pinyon-juniper woodlands. Miller and Tausch (2001) estimated that the area of pinyon-juniper woodlands has increased approximately 10-fold throughout the western United States since the late 1800s. Additionally, Wisdom *et al.* (2005) determined that 35 percent of the sagebrush area in the eastern Great Basin is at high risk to future displacement by pinyon-juniper woodlands and that mountain big sagebrush appeared to be most at risk, which could have meaningful impacts to sage-grouse brood rearing habitats within the upper elevations of mountain ranges within this region. In addition to this threat, much of the Great Basin is also susceptible to sagebrush displacement by cheatgrass. The most at risk vegetative community in this region is Wyoming-basin big sagebrush (Wisdom *et al.* 2005) located predominately within the lower elevation benches of mountain ranges. In some areas, this condition has already been realized and the future risk for existing sagebrush habitats is moderate to high. This threatens both breeding and winter habitats for sage-grouse. For example, in a study conducted within this region (in Eureka County, NV), Blomberg *et al.* (2012) determined that sage-grouse leks that were not impacted by exotic grasslands experienced recruitment levels that were six times greater than those impacted by exotic grasslands. Additionally, this study found that drought is a major contributor to reduced recruitment and low population growth within the Southern Great Basin. Other threats such as mining and infrastructure have the potential to affect this sage-grouse population due to mine expansions, as well as new mines and the infrastructure associated with them. Existing mining claims are virtually ubiquitous throughout the Southern Great Basin PAC. Overall, sage-grouse in the Southern Great Basin in Nevada are potentially at-risk.

Ibapah

The Ibapah portion of the Southern Great Basin population is also referred to as the Ibapah Management Area and is located in northwestern Utah. This area had an estimated 39 males on leks as of 2011, primarily on Goshute Tribal lands. The area boundary was determined by consulting with Nevada, the West Desert Adaptive Resource Management Local Area Working Group, and the Utah Division of Wildlife Resources and follows vegetation types used by sage-grouse. Sage-grouse in this area show resiliency to known threats. Key threats to sage-grouse are fire, invasive species (cheatgrass and knapweeds), potential loss of riparian areas due to water piping, predation, and habitat fragmentation (from dispersed recreation and pinyon-juniper encroachment).

Hamlin Valley

The Hamlin Valley portion of the Southern Great Basin population is also referred to as the Hamlin Valley Management Area. It is located in southwestern Utah, on the border of Utah and Nevada and is important due to its connectivity with other portions of the population. Although currently isolated from other habitat areas in Utah, habitat restoration could link this population to the South Central Utah population. This area consists of a relatively small number of birds (i.e., 89 males in 2011) that use less than 10 leks throughout the habitat area. This portion of the population is regarded as moderately stable with a high potential for growth. Key threats include wildfire, increased predator populations, vegetation management, wild horse management, and habitat fragmentation.

Quinn Canyon Range

This is a very small and isolated population located in southeastern Nevada. There were not enough data for Garton *et al.* (2011) to conduct an analysis on population trends or persistence. Two to three leks have been identified in this area, but there is very little information associated with these sites and most of this information is anecdotal. Habitat within this area has been compromised by pinyon-juniper encroachment. No PACs were identified for this population largely because the majority of vegetative associations are either salt desert shrub communities or pinyon-juniper stands. Very little sagebrush exists within this population. Overall this is a high risk population.

MANAGEMENT ZONE IV: SNAKE RIVER PLAIN

This zone represents one of the largest areas of connected sage-grouse habitat, as demonstrated by Knick *et al*. (2011), and supports the largest population of sage-grouse outside of the Wyoming Basin (Garton *et al*. 2011). The Snake River Plain management zone includes sage-grouse populations in Oregon, Idaho, Nevada, Utah and Montana. Garton *et al.* (2011) predicted a 10.5 percent chance this Management Zone will fall below 200 males by 2037, and a 39.7 percent chance it would fall below 200 males by 2107.

Baker

The Baker population has approximately the same distribution as the area covered by the Baker administrative unit identified in Oregon's Sage-grouse Conservation Strategy (Hagen 2011b). The Baker spring population was estimated to be 872 -1,650 birds in 2010, the smallest extant population of sage-grouse that is exclusively in Oregon. Garton *et al.* (2011) based their Baker population assessment on minimum estimate of 137 birds in 2007 and estimated a 61.9% chance there will be fewer than 50 birds in the population by the year 2037, similarly, there is 66.8% chance of fewer than 50 birds by 2137. The Oregon Department of Fish and Wildlife lek counts indicated more than 300 males in Baker County in 2011. Since systematic counts began in 1989, the number of counted males/lek has remained relatively stable (Hagen 2011b). Due to habitat and topography it has been assumed the Baker population has little connectivity with other sage-grouse populations. Recent telemetry information suggests that at least some birds move between the Weiser population in Idaho and the Baker population.

The Baker population is more at risk and likely less resilient, since connectivity to other populations appears limited (future genetics work will help clarify this). There is no redundancy in this population as all birds are believed to be in one general area. For the entire population, the environmental similarity to extirpated populations is high (Wisdom *et al*. 2011). Most (68%) of the sage-grouse habitat for the Baker population is in private ownership and 31% is administered by BLM (Hagen 2011b). This is the largest proportion of privately managed sage-grouse habitat for any population in Oregon. Consequently, there are limited regulatory mechanisms in place, making it uncertain as to whether state-recommended conservation measures and practices will be applied on the majority of lands within this population.

More than 80% of the historical sagebrush habitat for the Baker Population remains available today but steeper habitat and rugged topography reduces the suitability for sage-grouse. Nearly 300,000 acres in this region were identified as priority areas for conservation, and includes much of the current range of the Baker population. Invasive weeds and juniper encroachment are considered to be the primary threats to this population (Hagen 2011b), but other threats to this population include renewable energy development (primarily wind), energy transmission, and OHV recreation. Recently, thousands of acres of juniper have been treated in this region to benefit sage-grouse and other sagebrush obligates. Most of the area used by this population has been mapped as priority habitat.

East-Central Idaho

Areas within the East Idaho Uplands in the Blackfoot River drainage downstream from Blackfoot Reservoir have historically provided popular sites for greater sage-grouse hunters. The area is generally characterized by a high proportion of private and state land and a local working group has been actively pursuing conservation measures. Nevertheless little information is available on sage-grouse populations other than some limited location and attendance data on a few leks. No lek routes have been established within this area that would allow consistent monitoring of sage-grouse populations. This lack of data is largely due to very difficult access in most years during winter and spring. Analysis of limited data by Garton *et al.* (2011) suggests that this population has a low probability of persistence. Although causal observation and some historic data suggest the study area provides adequate breeding and nesting habitat, sage-grouse numbers appear to be very low. Initial summer surveys in 2011 suggested sage-grouse were reasonably widespread throughout the area. However, given the apparent overall quality of the habitat, sage-grouse numbers seem surprisingly low and difficult to explain. Factors that could act to reduce sage-grouse populations in this area include sagebrush treatments in breeding habitat, West Nile virus, and loss or fragmentation of winter range. Overall this population is considered high risk.

Southwest Montana

The Southwest Montana Population occurs in Beaverhead and Madison Counties, within a 60 mile radius of Dillon, MT. Segments of this population also make seasonal migrations into Idaho. Garton *et al*. (2011) analyzed the Southwest Montana population as 4 separate smaller populations (i.e., Bannack, Wisdom, Red Rock, and Bridges), but did not provide an analysis of the overall population. Telemetry data, however, has demonstrated considerable intermingling between each of these lek complexes, clarifying that these birds represent a single population (and could be more accurately described as four sub-populations). Priority areas for conservation encompass about 80 percent of the habitat associated with the Southwest Montana Population. These PACs were identified because of the relatively high density of sage-grouse and the genetic conduit this area provides with Idaho's birds. Habitat threats are generally limited to improper grazing management, isolated sagebrush control efforts, and expansion of conifers into sage-grouse habitat in localized instances. Habitat conversion on the Idaho side of this Management Zone may also affect this population to some extent. Both the Centennial and Big Hole valleys are focus areas for native habitat conservation for grayling, sage-grouse and other wildlife, resulting in considerable acreage enrolled in long-term and perpetual conservation agreements with private landowners. Given this population's size, limited habitat threats, and ties to Idaho's birds, the Southwest Montana population is characterized as being at a low level of risk.

Snake-Salmon-Beaverhead

Recent data indicates this large population extends into southwestern Montana. This area contains a large amount of publicly managed land (largely BLM and USFS). Within the southern portion of this population, wildfires and invasive species have continued to reduce the quality of habitat. The mountain Valley portions of this population appear to have relatively stable habitats. Thus far, energy development is very limited and there are few wild horses. A recent rate of change analysis indicates this population has been stable to increasing from 2007 to 2010. Garton *et al.* (2011) indicated that this population had virtually no chance of declining below 500 in the next 100 years. Population analysis indicates that sage-grouse have fluctuated around 5,000 males since 1992. Because of relatively large numbers of birds and stable to increasing populations, this population is considered low risk.

Belt Mountains

This population occurs within a broad intermountain valley that extends roughly from White Sulfur Springs south toward Livingston, within Meagher and Park Counties. This population experienced considerable habitat conversion to small grain cropping in the late 1960s through the 1980s, involving at least one key sage-grouse wintering area (Swenson *et al.* 1987). Ironically, some of these croplands have since been enrolled into the Conservation Reserve Program (CRP) but natural sagebrush recovery appears minimal. Garton *et al.* (2011) were unable to develop any population predictions due to a lack of sufficient data. This population is at least 50 miles distant from the nearest adjacent population. Timbered and mountainous terrain and expansive non-habitat barriers further isolate this population in nearly every direction. Sagebrush control projects, primarily using herbicides, and conversion to cropland and domestic seeded pastures have continued to affect portions of the remaining habitat during the past 20 years. More recently, isolated housing developments and limited drilling for oil and/or gas resources have impacted a relatively small portion of remaining sagebrush grassland habitats in this area. The small population size, isolation from other populations, and a history of significant habitat perturbations, some of which continue but perhaps at a slower rate, places this population as high risk.

Weiser

This small population in western Idaho did not have sufficient data to allow analysis by Garton *et al.* (2011). However, 2010 data indicated the area had 14 occupied leks. Recently some connection with the Baker, Oregon population has been documented. The area is generally characterized by a high proportion of private land and a local working group has been actively pursuing conservation measures. Because of relatively few birds, fragmented habitat and a large portion of existing habitat on private lands, this population is considered at risk.

Northern Great Basin

The Northern Great Basin population is a large population in Oregon, Idaho, Nevada, and Utah. It has been divided into the large portion in Oregon, Idaho, and Nevada and a smaller portion in northwestern Utah called the Box Elder area. This area contains a large amount of publicly managed land (largely BLM). The area also includes among the least fragmented and largest sagebrush dominated landscapes within the extant range of sage-grouse (Knick and Hanser 2011). However, the northern and eastern portions of the population are more environmentally similar to areas where sage-grouse have been extirpated (Wisdom *et al.* 2011).

Despite efforts to manage wildfire risks, wildfires and invasive species have continued to reduce the quality of habitat in portions of this area. Idaho's Murphy Fire Complex recently affected roughly 600,000 acres of habitat for this population. The 2012 Long Draw fire in Oregon affected 582,000 acres; 455,000 acres were considered either Core or Low Density sage-grouse habitat under Oregon's conservation strategy, of which 213,000 acres in a PAC.

A recent rate of change analysis indicated that at least part of this large population has been stable to increasing from 2007-2010. Garton *et al*. (2011) indicated that this population had virtually no chance of declining below 50 in 30 or 100 years. Population analysis indicated that sage-grouse will fluctuate around a carrying capacity that will decline from an estimated 6,770 males in 2007 to 1787 males in 2037 if current trends continue (Garton *et al.* 2011).

Oregon, Idaho, and Nevada Portion

Redundancy and representation appear to be captured adequately in the PACs. In Oregon, PACs capture 95 percent of all known breeding locations, 98 percent of known wintering locations (which was expected since this was based on telemetry data), and 89 percent of known summer locations. Priority areas for conservation and low density (non-priority but managed) habitat combined capture all but three percent of known summer, one percent of known breeding, and one percent of known wintering habitat. Oregon PACs also considered the need to maintain a network of connected habitats.

The Nevada portion of the Northern Great Basin population represents the largest, most contiguous concentration of sage-grouse in Nevada and includes the Santa Rosa, Desert, Tuscarora, North Fork, O'Neil Basin, Islands, Snake and Gollaher Population Management Units. Portions of this area are well connected with Oregon, Idaho and Utah. Fire and invasive annual grasses are the major threats to the Nevada portion of this population. Since 2000, over 800,000 acres of sagebrush habitats have burned in this region. Rehabilitation efforts and the higher elevation/higher precipitation zones for some recent wildfires have led to expedited habitat recovery that is once again being utilized by sage-grouse demonstrating at least some resiliency for this portion of the population.. Winter habitat in some areas has been compromised although recent winter snowpack has been below average, allowing birds to utilize an expanded area. The Gollaher and Tuscarora population management units have been prone to wildfire and are more susceptible to invasive species such as cheatgrass. Mining and infrastructure have potential to pose additional threats to sage-grouse habitat as gold prices have increased 112% over the last 5 years and mining claims are numerous within the Nevada portion of the Northern Great Basin.

Oregon represents the western part of this large population which is shared with southern Idaho, NE Nevada, and NW Utah. Within Oregon, this represents one of the largest populations. The delineation of the Northern Great Basin population doesn't correspond well to any existing assessment for Oregon, but does include almost all of the Vale administrative unit, as well as portions of the Burns administrative unit. In Oregon alone, the spring population in the Northern Great Basin is likely several thousand birds, with 2011 spring lek counts approaching 3,000 males (in the Beulah, Malheur River, Owyhee, and eastern portion of Whitehorse Wildlife Management Units). Garton *et al.* (2011) estimated for the Northern Great Basin a minimum population estimate of 9,114 males in 2007 (includes S. ID, NE NV, NW UT). Modeling suggested there is a 2.5% chance birds will drop below 500 by the year 2037, but a 99.7% chance the population will be below 500 by 2137 (Garton *et al*. 2011). Loss of sagebrush habitat has been and continues to be threat to the population in Oregon. Between 1963 and 1974, 500,000 acres of sagebrush habitat was seeded to crested wheatgrass or sprayed with herbicide, and 1,600 water developments and 463 miles of pipeline were installed in the Vale District BLM's area for the Vale project. More recently, wildfire is the most significant threat to landscape scale losses of sagebrush habitat as indicated by the previously mentioned 582,000 acre Long Draw fire of 2012. In conjunction with fire, invasive weeds are also one of the greatest risks the 4+ million acres of sagebrush habitat for this population in Oregon. More than

580,000 acres is already dominated by invasive species (Hagen 2011b). In many instances, these areas were historically dominated by Wyoming big sagebrush habitat. Other threats in this region include mining development, renewable energy development, transmission, and juniper encroachment at higher elevations. West Nile virus has also been consistently detected in mosquitoes in this region (http://public.health.oregon.gov/) and the population was subjected to the largest known West Nile virus mortality event involving sage-grouse in Oregon (2006). Despite efforts to manage wildfire risks, wildfires and invasive species have continued to reduce the quality of habitat in portions of this area. Largely due to the landscape altering potential of very large wildfires, with recent years as evidence, overall this part of the population is potentially at risk.

Box Elder

The Box Elder portion of the Northern Great Basin population is located in northwestern Utah. This area is referred to as the Box Elder Management Area. It had an estimated 755 males on leks as of 2011. This population is regarded as stable with a potential for growth. Key threats include wildfire, invasive species, loss of agricultural operations, and habitat fragmentation. The area can likely sustain increases in sage-grouse populations with continued reclamation and restoration. As a result, this area should be a high priority for funding of habitat enhancement. Because this area is a portion of the large Northern Great Basin population, it is potentially at risk.

Sawtooth

This small population in central Idaho did not have sufficient data to allow analysis by Garton *et al*. (2011). No occupied leks are known to exist at this time. This area is largely encompassed by the Sawtooth National Recreation Area and includes a high proportion of public land. This population declined to one male on one lek in 1986 and was subsequently increased by translocation during the mid-1980s. Overall this population is at high risk.

MANAGEMENT ZONE V: NORTHERN GREAT BASIN

There are four sage-grouse populations identified in this management zone, including Central Oregon, Klamath, Warm Springs Valley, and the Western Great Basin. Garton *et al.* (2011) predicted a 2.1 percent chance this Management Zone will fall below 200 males by 2037, and a 29.0 percent chance it would fall below 200 males by 2107. Only two of the populations (Central Oregon and Western Great Basin) had sufficient information for a population assessment by Garton *et al.* (2011). BLM lands are a major constituent of sagebrush landscapes in the Northern Great Basin (62 percent), followed by private (21 percent), Forest Service (10 percent), state (8 percent), and then other ownerships (Knick 2011). This zone is part of a stronghold for sage-grouse (that includes Management Zones III, IV, and V) because the three zones contain the largest area of habitat range-wide with low similarity to extirpated portions of the range (Wisdom *et al.* 2011).

Central Oregon

The Central Oregon population has approximately the same distribution as the area covered by the Prineville administrative unit identified in Oregon's Sage-grouse Conservation Strategy. Approximately 700,000 acres of habitat for the Central Oregon population has been identified as priority areas for conservation. This is a relatively large population, with the minimum spring population estimated at 1,775-2,084 birds in 2010 (Hagen 2011b). The population has declined steadily since 1980 (average, -0.004 percent/yr [Hagen 2011b]). There is a 15.2 percent chance the population will decline below 500 by 2037, and a 91.3 percent chance that fewer than 500 birds will be in the population by 2137 (Garton *et al*. 2011).

This population is estimated to have only 53 percent of historic sagebrush habitat, having lost more historic habitat than any other sage-grouse administrative unit in Oregon. The area also has more privately owned sage-grouse habitat (48 percent) than most other sage-grouse management zone populations in Oregon. This population faces a wide suite of threats, including juniper encroachment, (Freese 2009) which threatens over 900,000 acres of the 1.8 million acres of sagebrush habitat in in this area (Hagen 2011b). Additional threats include invasive weeds, renewable energy development (both wind and geothermal), transmission, roads, OHV recreation, and residential development. Projections based on historic trends suggest this population is at risk, but in the last 2 years there have been a number of positive developments including thousands of acres of habitat improvement under the NRCS's Sage-grouse Initiative and increasing local interest sage-grouse conservation. Juniper encroachment does threaten connectivity with other Oregon populations to the south and east (Hagen 2011b).
Based on Garton *et al.* (2011), this population appears fairly resilient in 30 years, but not in 100 years. Redundancy and representation appear to be captured adequately. PACs capture 95 percent of all known sage-grouse breeding locations, 98 percent of known wintering locations, and 89 percent of known summer locations. Priority areas for conservation and low density (non-priority but managed) habitat combined capture all but three percent of known summer, one percent of known breeding, and one percent of known wintering habitat. Since this population's habitat/landscape appears more similar to landscapes in extirpated populations than extant populations, particularly in the northwest extant of range (Wisdom *et al.* 2011), we suggest retaining all priority habitats for this populations. Most of the sites within this population (with the possible exception of the southwestern site) probably have some connectivity with other sites in this population, though verification from genetics is lacking. Although much of the known habitat is mapped, we suggest retaining all PACs in Central Oregon.

Klamath

The Klamath population is all that remains of a population that once extended from northern California through southern Oregon. The California portion includes the Devil's Garden Area of Modoc County, which had at least 46 known leks as recently as the 1970s, and was well connected to populations in Oregon and the Western Great Basin. By the early 2000s, only one known lek remained on the Clear Lake National Wildlife Refuge in California, with less than 10 males. Since 2005, birds have been translocated from Oregon and Nevada to the refuge to prevent extirpation. A small amount of priority habitat is mapped for the area where birds

currently exist, but not connected to the Western Great Basin or Central Oregon populations. Redundancy is not adequate and resistance is poor. This population is at immediate risk of extinction without continued augmentation. There is no priority habitat mapped in this population for Oregon because we have not documented birds there recently.
There are no priority areas for conservation mapped for this population in Oregon because sage-grouse in the Oregon part of the Klamath population are thought to be extirpated. As recently as the early 1990's, a few birds attended leks in Oregon, but there have been no confirmed sightings since 1993, despite periodic survey efforts. The Klamath population was likely an extension of the population in northeast California and likely had limited connectivity with sage-grouse populations in eastern Oregon due to barriers of unsuitable habitat. Habitat in both California and Oregon is severely compromised by juniper encroachment, wildfire, and invasive grasses. Significant juniper treatments have taken place in and around the area currently occupied by sage-grouse and in the former Oregon range. There is potential for limited range expansion for sage-grouse in the future.

Warm Springs Valley

This is a small population that exists in southern Washoe County within the Virginia Population Management Unit. Only two confirmed active leks comprise this population; however, lek size is relatively large (average of over 40). The identified PACs encompass the majority of use areas. Extensive research has been conducted within this particular Population Management Unit. Some individuals have dispersed to the southern portion of the western Great Basin population during the winter, so there is the possibility of genetic interchange. There is an indication of this from work conducted by Oyler-McCance *et al*. (2005) suggesting a relationship with the Lassen population in California. Representation and redundancy are limited within this population due to its small size, proximity to urbanized setting and threats from invasive species.

The Warm Springs population in southern Washoe County may be close to a threshold if additional threats occur. This population is very close to urban areas, has experienced large wildfire and energy development in the form of a utility scale transmission line (345kV Alturas line) and water transfer pipeline (Vidler Water), and is experiencing some pinyon-juniper encroachment. However, the primary area used by sage-grouse in the population (Spanish Flat) remains intact and benefits from higher elevation precipitation regimes. Overall, this is population is at risk.

Western Great Basin

The Western Great Basin population is shared among southeastern Oregon, northeastern California and northwestern Nevada. Range-wide for sage-grouse, this area contains one of four remaining large intact expanses of sagebrush habitat and connects south-central Oregon with northwest Nevada, with most of the sagebrush dominated landscape in Oregon (Knick and Hanser 2011). Habitat fragmentation increases to the south and west in the population, with northeast California having a high similarity with portions of extirpated range (Wisdom *et al.* 2011). Garton *et al.* (2011) estimated for the Western Great Basin a minimum population estimate of 5,904 males in 2007 (includes NE CA, NW NV). Over 8 analysis periods conducted by Garton *et al*. (2011), average rates of change were <1.0 in 3 of those periods and the minimum population estimate was determined to be 5,904 males in 2007 based on counts at 393 leks. Modeling suggested there is a 6.4 percent chance birds will drop below 500 by the year 2037, but a 99.1 percent chance the population will be below 500 by 2137 (Garton *et al.* 2011). The Western Great Basin is the most resilient population in Management Zone 5, but reducing threats alone is not likely to ensure long-term persistence in some areas. Resiliency needs to be improved in the California and Nevada portions of the Western Great Basin with increased habitat suitability in terms of shrub densities and native grasses and forbs.

Oregon's portion of the population has some of the best habitat and highest sage-grouse densities in the state, including Hart Mountain National Antelope Refuge and Trout Creek Mountains, though habitat in the Trout Creeks was likely compromised by 2012 fires. The delineation of the Western Great Basin population doesn't correspond well to any existing assessment for Oregon, but does include almost all of the Lakeview administrative unit, as well as portions of the Burns and Vale administrative units. In just Oregon, the spring population in the Western Great Basin likely exceeded 10,000 birds in 2010 (interpolation from Hagen 2011b). In the Oregon, >80 percent of the historical sage-grouse habitat remains intact, and most of the habitat is in public ownership (Hagen 2011b). In the Lakeview administration unit, which comprises most of the Western Great Basin population in Oregon, about 78 percent of the region is administered by the BLM and the FWS manages more than 278,000 acres. Invasive weeds, fire, and juniper encroachment (particularly on the western edge) represent the greatest risks to this population. Renewable energy development (wind and geothermal) and wild horses have been identified as a threat to sage-grouse habitat in portions of Oregon's (e.g., Steens, Dry Valley/Jack Mountain Action Areas) Western Great Basin population. Given the majority of this population occupies federal land, proper and proactive habitat management could ensure the persistence of this sage-grouse population well into the future. Redundancy and representation appear to be captured adequately in the Oregon portion of this population given that priority habitats include most of the known distribution of birds (see rationale in Central above).

The California portion of the Western Great Basin includes the majority of the Buffalo-Skedaddle Population Management Unit. Priority habitat in California includes 100 percent of known sage-grouse distribution. This population was part of a much larger population that was connected to the Klamath population into the 1970's. Habitat degradation, including juniper expansion and spread of exotic grasses has been extraordinary in this region, resulting in range contraction over the past few decades. In August, 2012, the Rush Fire burned more than 265,000 acres of PACs in California and more than 313,000 acres including Nevada. Most of the largest leks and important nesting habitats were within the fire perimeter. Furthermore, the fire was focused on the East Lassen area to the east of Highway 395, which connects to the Western Great Basin Population in Nevada. The remaining area occupied by grouse in Central Lassen on the western periphery of the range may be further isolated by this fire. The extant population was considered well connected prior to the fire, but connectivity post-fire is unclear. The California portion of the Western Great Basin had experienced recent positive population trends, demonstrating that the population could exhibit positive growth rates during years of favorable environmental conditions. However, habitat suitability pre-fire was considered low (Davis 2012) and was in need of improvement to increase resistance of this population. The full effects of this large-scale wildfire are unclear at this time. The Nevada portion of this population includes the Buffalo/Skedaddle, Massacre, Vya, Sheldon, Black Rock, Pine Forest and Lone Willow Population Management Units. Currently identified priority habitat encompasses an area greater than the 85 percent core breeding density as reconstructed by the Nevada Department of Wildlife using methods described by Doherty *et al.* (2010), but utilizing the 10-year average for lek attendance rather than the most recent peak. Redundancy and representation are adequately captured both within the Nevada portion of this population and certainly within the Western Great Basin population as identified by Garton *et al*. (2011).

The Lone Willow portion of the Western Great Basin population (connected with Oregon) was affected by a very large wildfire in 2012. The Holloway Fire burned approximately 214,000 acres in Nevada and 245,000 acres in Oregon of which about 140,000 acres in Nevada and 221,000 acres in Oregon were considered important or essential sage-grouse habitat. The Miller Homestead fire in Oregon included an additional 162,000 acres of sagebrush habitat within its perimeter, 149,000 acres of which was identified as a PAC for the Western Great Basin population. Fire and annual grasses should be characterized as substantial and imminent threats within this portion of the population. Additionally, this area faces threats from lithium and uranium exploration and extraction. Along with infrastructure that may come with this potential development, it may be appropriate to characterize mining and infrastructure as substantial, non-imminent threats to this portion of the population.

Both the Massacre and Buffalo/Skedaddle Population Management Units face high risk due to invasive species being pervasive within the understory of lower elevation sagebrush communities. Improper livestock grazing practices and wild horse utilization have caused severe habitat degradation in some instances, especially with respect to meadow, spring and riparian habitats. Within the Massacre PMU, important information relative to habitat condition is contained within the BLM's Environmental Assessment for a Wild Horse Population Management Plan within the High Rock Complex (DOI-BLM-CA-N070-2011-04-EA). Appendix F of this document provided the results of Rangeland Health Assessments (RHAs) across five Herd Management Areas (HMAs). Within the "Standards for Biodiversity" sections of these RHAs, of the 28 sites assessed, 50% of them were not meeting biodiversity standards. This was mainly due to a lack of an adequate quantity of key deep-rooted perennial grasses such as Thurber's needlegrass, bluebunch wheatgrass and Idaho fescue, but also due to poor riparian condition as well. Whether or not this condition is the result of historic or current livestock grazing practices and/or wild horse utilization is debatable, but the fact that it continues to exist requires more appropriate management actions to improve the condition of the habitat. Since much of this region is susceptible to annual grass establishment, it is important that the perennial grass understory is maintained and perpetuated to help curtail the invasion of species like cheatgrass. This is supported by the findings of Blank and Morgan (2012) where, relative to controls, established perennial grasses significantly hindered the growth of cheatgrass. In addition to less than adequate upland conditions, this EA also found that riparian areas, spring and meadow complexes were damaged as well. The EA reports: "Riparian functional assessments completed in 2010 have determined that most riparian sites within the High Rock Complex are "Functional at Risk" (66%), and several other sites (17%) are rated as "Nonfunctional". This means that the majority of sites (83%) are in an obvious degraded condition. Sites rated as FAR are in danger of becoming "Nonfunctional" if the stresses and disturbances causing these conditions are allowed to continue. The dominant causal factors for riparian and wetland sites not being rated as PFC is grazing and trampling from livestock and wild horses. Many sites have recorded causal factors for not achieving PFC as continuous, year round use by wild horses.

Within the Sheldon National Wildlife Refuge, wild horses were rated as the highest risk to sage-grouse habitat quality by the Washoe-Lassen-Modoc local working group. This assessment was further justified within the Sheldon National Wildlife Refuge Comprehensive Conservation Plan (CCP) which identified management of feral horses and burros as the most important issue affecting the ability of the Service to fulfill the purposes for Sheldon Refuge (USFWS 2012). Additionally, an Environmental Assessment prepared by the USFWS (USFWS 2008) determined that wild horses and burros had direct adverse impacts to biological integrity, diversity and environmental health within Sheldon Refuge.

The Western Great Basin is most resilient in MZ5, but reducing threats alone is not likely to ensure long-term persistence in some areas. Resiliency needs to be improved in the California portion of the Western Great Basin with increased habitat suitability in terms of shrub densities and native grasses and forbs. Additionally, for this population to retain its resiliency, significant efforts are needed to ensure post-fire habitat recovery and prevent dominance of non-native vegetation. Overall this population is considered potentially at risk.

MANAGEMENT ZONE VI: COLUMBIA BASIN

There are four identified populations in Management Zone VI, which exists mostly in Washington State. Two of these populations, Moses Coulee and Yakima Training Center, are extant populations that were identified and assessed by Garton *et al.* 2011. The additional populations are Crab Creek and Yakama Nation, both of which were addressed with the aid of translocated individuals. Based on information collected at Moses Coulee and Yakima Training Center, Garton *et al*. (2011) predicted a 76.2 percent chance that this population would dip below 200 males in the next 30 years and 86.3 percent chance it would dip below 200 by 2107. Along with the Colorado Plateau, leks in this management zone are the least connected (Knick and Hanser 2011). The PACs likely are large enough to support the current populations and the recovery areas encourage the expansion needed to improve the overall viability. The small size of existing populations and lack of current viability in this management zone means that current management direction (target toward recovery rather than maintenance) is different than in other management zones.

The PACs within this management zone capture redundancy and representation within the management zone, assuming that the protections and management prescriptions area adequate within these areas and they are followed. The PACs were specifically chosen to protect the identified populations. However, because the populations in this management zone are not believed to be viable at this time, the area of protection is larger and designed to include recovery areas which are needed to support a larger, more connected, and hopefully viable population in the future. Based on population viability, it is unlikely that any of the populations in this zone are resilient to threats or disturbances. The order of descending risk is Yakama Nation, Crab Creek, Yakima Training Center, and Moses Coulee.

Moses Coulee

The Moses Coulee population has been maintaining its number for the last 30 years, largely due to the support of farm programs. However, the lower risk of Moses Coulee does not mean that the population is at no risk. This population is at risk. In 2007, 230 males were counted in this population (Garton *et al*. 2011); they estimated an 88 percent probability that the population would dip below 200 males by the year 2037 or close to a 100 percent probability that the population would dip below 200 males by the year 2107. The estimated a 62 percent probability that the population would dip below 20 males by 2107. Despite these dire concerns, the Moses Coulee population of males was estimated to be about 350 in 2012 (Schroeder *et al*. 2012).

Major issues in Moses Coulee are the lack of habitat stability due to the abundant private land, habitat fragmentation, and dependence on farm programs. There is public land managed by the Washington Department of Fish and Wildlife, BLM, Washington and Department of Natural Resources, but the public land is relatively sparse compared to the quantity of private land (Stinson *et al*. 2004). The abundance of private land adds to the management uncertainty. Because of relatively large amounts of enrollment in CRP and State Acres for Wildlife Enhancement (SAFE) programs, there is a great deal of support for sage-grouse in the Moses Coulee area at least for the next decade. Even so, the high degree of fragmentation and 'subsidized' predators (subsidized with road kill, orchards, and nesting and perching structures) increases the overall predation rate.

Yakama Nation

The Yakama Nation population is extremely small with extremely low viability, if any. The area was historically occupied, but the extinction of the endemic population was not precisely documented (Schroeder *et al*. 2000). During 2006-2008 sage-grouse were translocated to the Yakama Nation in an attempt to re-establish a population. Although it is still too early to evaluate success, the results are not promising at this time. The Yakama Nation faces many threats to their sage-grouse population including poor habitat quality, small population size, and lack of connectivity with existing populations, and wild horses. The wild horse population is severe in portions of the Yakama Nation. It is not clear if the Yakama will be able to aggressively deal with the horse issue. On the positive side, the land is owned by the Yakama Nation and the strictly control access. Consequently, they have a great deal of management control as well as interested in recovering a population of sage-grouse on their land. This population is considered high risk.

Crab Creek

The Crab Creek was occupied by sage-grouse until the mid-1980s (Schroeder *et al*. 2000). By the mid-1990s the Washington Department of Wildlife and the BLM had acquired and/or consolidated approximately 50,000 acres in the Crab Creek area. Because sage-grouse were a priority for management on many of these acres and management direction was altered in favor of sage-grouse, it was believed that this area could once again support sage-grouse. Translocations were initiated in 2008 (Schroeder *et al.* 2012). In 2012, the number of males counted on a single lek was 13. Based on survival and productivity, the potential for this population appears promising. However, it is still too early to determine if the re-establishment effort was successful. The primary risk factors for this population include its small size, habitat fragmentation, and the risk of losing acres formerly enrolled in farm programs (CRP and SAFE). This population is considered high risk.

Yakima Training Center

The second most resilient population in this zone is the Yakima Training Center population which is much smaller than Moses Coulee, but is almost entirely public land. Long-term viability is anything but certain. In 2007, 85 males were counted in this population (Garton *et al*. 2012); they estimated a 26 percent probability that the population would dip below 20 males by the year 2037 or 50 percent probability that the population would dip below 20 males by 2107. The number of males counted in 2011 was 72 (Schroeder *et al.* 2012). The use of the Yakima Training Center for military training activities and the risk of fire have reduced the overall suitability of the habitat supporting this population. A substantial amount of the sage-grouse habitat on the area has been harmed directly and indirectly military training activities, particularly due to wildfires. Despite efforts to manage wildfire risks, wildfires have continued to reduce the quality of habitat in the population. Other key factors in this population are two interstate highways (I 82 and I 90) which border the population on north and west side, powerlines which border the population on the north, west, and south sides, the Columbia River Valley which is natural but reduces movement on the east side, and wind development on the north side. The cumulative effect of these factors is that the population is constricted with little opportunity for expansion. On the positive side, the population occupies and area dominated by public land. This population is considered high risk.

MANAGEMENT ZONE VII: COLORADO PLATEAU

This management zone contains two populations; Parachute-Piceance Basin and Meeker-White River Colorado. The designated priority areas for conservation appear to capture redundancy and representation. Priority habitats are well mapped and include all high use habitat (which includes breeding, summer, and winter habitat within 4 miles of all known leks) and linkage zones to Management Zone 2 to the north. There is no known connectivity with Utah

(Management Zone 3 to the west) due to natural habitat fragmentation and large areas of non-habitat.

Parachute-Piceance-Roan

The Parachute-Piceance-Roan Basin population appears to be captured within priority areas for conservation, and representation appears to be captured adequately. Priority areas for conservation capture 60 percent of the occupied range in this population and also include 100 percent of all known active leks and all habitats that were modeled "high probability of use" within four miles of a lek that has been active in the last 10 years. Redundancy is not captured within this population because it is a relatively small (three year running average number of males is 93) and somewhat isolated. This population is on the very southern edge of the species range. There is some potential for connectivity to the north to the Wyoming Basin population in Management Zone 2. Linkage habitats have been included in mapping efforts. Representation and redundancy are at risk within this population due to its small size, energy development and the associated infrastructure, especially road development. Pinyon-juniper encroachment is also an issue. The Parachute-Piceance-Roan population appears to have some resiliency. The population has been monitored since 2005 and appears to be fluctuating similar to other larger populations in the state. A large majority of PACs are privately owned, mostly by energy companies. Energy and mineral development is the highest ranked threat to sage-grouse in this area. Advances in drilling technology and rapid natural gas demand and subsequent rising prices have led to a significant increase in natural gas drilling activity. Road and infrastructure are also ranked high as they are closely related to energy production. Historic habitat has been lost and fragmented also by pinyon-juniper encroachment. This population is considered to be at high risk.

Meeker-White River Colorado

This population is located just northeast of Parachute-Piceance-Roan Basin. There is no redundancy and little representation in the Meeker-White River population (three-year running average high male count is six birds). Priority areas for conservation capture 27 percent of the occupied range in this population and include the only known active lek. All habitats modeled "high probability of use" and within four miles of any lek (active in the last 10 years) are within priority habitat. Representation and redundancy are at risk within this population due to its small size, proximity to an urbanized setting and, thus, housing development and associated infrastructure and agriculture conversion. This is a very small population located near the town of Meeker and consists of only one active lek that was discovered in 2004, and strutting male counts have been on a steady decline since (e.g., from a high of 30 males in 2004 to six males in 2012). Most of the occupied habitat is privately owned (90 percent) and is in two disconnected patches of habitat, separated by the White River. One of the patches remains unfragmented. The other patch is located where housing development will primarily occur. Meeker-White River has lost resiliency. The population has been monitored since 2004 and the population has been in a steady decline from 30 males to the current six males. Housing development is increasing mainly due to energy development in nearby counties. A large part of the habitat was converted to agriculture in the 1960's, which is likely a primary reason why the population went into decline. A current issue is that some of the lands in pasture and CRP land may now be converted back to crop lands. This population is considered to be at high risk.

BI-STATE DPS

The Bi-State Distinct Population Segment (Bi-State DPS) is geographically and genetically isolated from other populations of greater sage-grouse (Oyler McCance *et al.* 2005, Benedict *et al.* 2003). Four populations are identified in the Bi-State DPS, including: Pine Nut, North of Mono Lake, South of Mono Lake, and the White Mountains. These populations are delineated based on a fair degree of geographic and genetic isolation within the overall Bi-State DPS. Within the Bi-State, all occupied habitat is considered PAC. Two core populations exist to the north and south of Mono Lake, with small peripheral populations in the Pine Nut Range to the north and White Mountains to the south. Garton *et al.* (2011) indicate that long-term persistence is questionable for both core populations with a high probability of dropping below effective population sizes of 50 birds in the next 100 years (100 percent for North Mono and 81.5 percent for South Mono). However, probability of dropping below effective population sizes of 50 birds is low in the next 30 years (15.4 percent for North Mono and 0.1 percent for South Mono. The Bi-State DPS has grown consistently each year from 2008–2012 to the highest population size on record, presumably in response to a trend in higher precipitation and favorable range conditions. Relatively large population increases have been seen in the core populations to the north and south of Mono Lake that have multiple well-connected leks, while peripheral populations have not seen these population increases. The Bi-State DPS is still represented in most of the known historic distribution, but threatened by small and isolated populations on the periphery of the range. Genetic diversity remains high in most of the Bi-State DPS, with emerging evidence that representation has been lost in some areas by population reduction and some loss of genetic diversity.

North Mono Lake

The population to the north of Mono Lake consists of a central stronghold located in the Bodie Hills, CA, and several additional peripheral populations in CA and NV that vary in size and degree of isolation. The Bodie Hills population has grown in recent years to be the largest and most connected population in the Bi-State, with more than 500 males counted on leks in 2012. The Bodie Hills breeding complex has about 9 to 11 core leks, ranging from about 100-500 males counted over the past 20 years. The Bodie Hills breeding complex appears to be best connected with the Aurora, Rough Creek and Nine Mile Flat area within the Mount Grant PMU in Nevada. This area, plus Mount Grant proper in the Wassuk Range contains eight active leks. The Fales area in California, consisting of two known leks at Wheeler Flat and Burcham Flat on the northwestern edge of this population, is largely isolated from Bodie, but probably has some connectivity to another small population at Jackass Spring along the border and Desert Creek/Sweetwater Flat in NV. The Fales population was much larger prior to the early 1980's and has experienced the greatest population declines in California, with less than 100 males counted on leks in 2012. The core population to the north of Mono Lake in total appears to be fairly resistant but individual subpopulations much less so. While the population remains relatively stable, the size and geographical extent is moderately small and the degree of historic impacts has not been severe. Although there is good resistance in the core of this population, additional threats should be avoided in both the core and peripheral areas. The North Mono Lake population is the largest population in the Bi-State and least isolated, and is potentially at risk because of periodic fluctuations in population size, and multiple threats to the population.

South Mono Lake

The population to the south of Mono Lake consists of a central stronghold located in Long Valley, CA. The Long Valley and Bodie Hills populations are considered the two main core populations in the Bi-State DPS. Similar to Bodie, the Long Valley population has grown in recent years, with more than 400 males counted on leks in 2012. Similar to the Bodie Hills, the Long Valley breeding complex contains about 9-11 core leks, with about 150-400 males counted over the past 20 years. One additional breeding population located at Parker Creek in CA is considered isolated from Long Valley and only known to contain one lek. The Long Valley breeding complex remains relatively stable and resistance to ongoing impacts is generally good. As with the North Mono population, however, this breeding complex is not overly large. The Long Valley population is probably more vulnerable than Bodie because it is considered isolated from other Bi-State populations and seasonal habitats are limited to a relatively small area. Therefore, this population could be severely impacted by catastrophic events, and further cumulative threats should be avoided. The Parker population is probably fewer than 100 estimated birds total and lacks resistance. The South Mono Lake is currently relatively large population, but is potentially at risk because of isolation, periodic fluctuations in population size, and multiple threats to the population.

Pine Nut

The Pine Nut population is the smallest and most threatened population in the Bi-State DPS. The population consists of one consistently active lek, although there is indication that additional sites may be present and there is some connectivity to the population to the north of Mono Lake. The long-term average male attendance is approximately 14 males over the past 11 years. The population appears predisposed to environmental vagaries in the form of wildfire and drought as well as additional anthropogenic stressors that have and continue to influence the population. These conditions have resulted in a population that is largely nonresistant to additional impacts. The Pine Nut population is classified as high risk because of very low population size and relatively high level of threats.

White Mountains

The population in the White Mountains is not well understood because of difficulty in accessing the area to conduct lek surveys. However, at least one lek is known to exist at Chiatovich Flat in California and 2 recently discovered leks are known to exist in NV. As with the other Bi-State breeding populations, sage-grouse in the White Mountains are probably mostly threatened by small population size and are therefore vulnerable to catastrophic events. However, this population, located in high elevation habitats on the extreme southwest of the species range, has probably always been small and faces the fewest threats in the Bi-State DPS. The White Mountains are classified as potential risk because of the aforementioned uncertainty regarding population size, but has the least land use threats in the Bi-State DPS.

APPENDIX B—POLICY FOR THE EVALUATION OF CONSERVATION EFFORTS WHEN MAKING LISTING DECISIONS

preferred the rulemaking petition. The coordinates for Channel 287C3 at Alamo are 32–19–29 North Latitude and 82–43–23 West Longitude. This allotment has a site restriction of 20.4 kilometers (12.7 miles) north of Alamo.

DATES: Effective April 28, 2003.

FOR FURTHER INFORMATION CONTACT: R. Barthen Gorman, Media Bureau, (202) 418–2180.

SUPPLEMENTARY INFORMATION: This is a synopsis of the Commission's Report and Order, MM Docket No. 01–111, adopted March 12, 2003, and released March 14, 2003. The full text of this Commission decision is available for inspection and copying during normal business hours in the FCC's Reference Information Center at Portals II, 445 12th Street, SW., Room CY–A257, Washington, DC, 20554. The document may also be purchased from the Commission's duplicating contractor, Qualex International, Portals II, 445 12th Street, SW., Room CY–B402, Washington, DC, 20554, telephone 202 863–2893. facsimile 202 863–2898, or via e-mail *qualexint@aol.com.*

List of Subjects in 47 CFR Part 73

Radio, Radio broadcasting.

■ Part 73 of Title 47 of the Code of Federal Regulations is amended as follows:

PART 73—RADIO BROADCAST SERVICES

■ 1. The authority citation for Part 73 reads as follows:

Authority: 47 U.S.C. 154, 303, 334 and 336.

§ 73.202 [Amended]

■ 2. Section 73.202(b), the Table of FM Allotments under Georgia, is amended by adding Alamo, Channel 287C3.

Federal Communications Commission.

John A. Karousos,

Assistant Chief, Audio Division Media Bureau.

[FR Doc. 03–7470 Filed 3–27–03; 8:45 am]

BILLING CODE 6712–01–P

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 73

[DA 03–629; MB Docket No. 02–120; RM–10442]

Radio Broadcasting Services; Owen, Wisconsin

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: The Audio Division, at the request of Starboard Broadcasting, Inc., allots Channel 242C3 at Owen, Wisconsin, as the community's first local FM service. Channel 242C3 can be allotted to Owen, Wisconsin, in compliance with the Commission's minimum distance separation requirements with a site restriction of 12.9 km (8.0 miles) northeast of Owen. The coordinates for Channel 242C3 at Owen, Wisconsin, are 45–03–08 North Latitude and 90–29–21 West Longitude. A filing window for Channel 242C3 at Owen, WI, will not be opened at this time. Instead, the issue of opening this allotment for auction will be addressed by the Commission in a subsequent Order.

DATES: Effective April 28, 2003.

FOR FURTHER INFORMATION CONTACT: Deborah Dupont, Media Bureau, (202) 418–2180.

SUPPLEMENTARY INFORMATION: This is a synopsis of the Commission's Report and Order, MB Docket No. 02–120, adopted March 12, 2003, and released March 14, 2003. The full text of this Commission decision is available for inspection and copying during normal business hours in the FCC Information Center, Portals II, 445 12th Street, SW., Room CY–A257, Washington, DC 20554. The complete text of this decision may also be purchased from the Commission's duplicating contractor, Qualex International, Portals II, 445 12th Street, SW., Room CY–B402, Washington, DC, 20554, (202) 863–2893, facsimile (202) 863–2898, or via e-mail *qualexint@aol.com.*

List of Subjects in 47 CFR Part 73

Radio, Radio broadcasting.

■ Part 73 of title 47 of the Code of Federal Regulations is amended as follows:

PART 73—RADIO BROADCAST SERVICES

■ 1. The authority citation for part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 303, 334 and 336.

§ 73.202 [Amended]

■ 2. Section 73.202(b), the Table of FM Allotments under Wisconsin, is amended by adding Owen, Channel 242C3.

Federal Communications Commission.

John A. Karousos,

Assistant Chief, Audio Division, Media Bureau.

[FR Doc. 03–7472 Filed 3–27–03; 8:45 am]

BILLING CODE 6712–01–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Chapter IV

[Docket No. 000214043–2227–02; I.D. 011603A]

RIN 1018–AF55, 0648–XA48

Policy for Evaluation of Conservation Efforts When Making Listing Decisions

AGENCIES: Fish and Wildlife Service, Interior; National Marine Fisheries Service, NOAA, Commerce.

ACTION: Announcement of final policy.

SUMMARY: We, the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) (the Services), announce a final policy for the evaluation of conservation efforts when making listing decisions (PECE) under the Endangered Species Act of 1973, as amended (Act). While the Act requires us to take into account all conservation efforts being made to protect a species, the policy identifies criteria we will use in determining whether formalized conservation efforts that have yet to be implemented or to show effectiveness contribute to making listing a species as threatened or endangered unnecessary. The policy applies to conservation efforts identified in conservation agreements, conservation plans, management plans, or similar documents developed by Federal agencies, State and local governments, Tribal governments, businesses, organizations, and individuals.

DATES: This policy is effective April 28, 2003.

ADDRESSES: Chief, Division of Conservation and Classification, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, Arlington, VA 22203 (Telephone 703/358–2171, Facsimile 703/358–1735); or Chief, Endangered Species Division, National Marine Fisheries Service, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910 (Telephone 301/713–1401, Facsimile 301/713–0376).

FOR FURTHER INFORMATION CONTACT: Chris Nolin, Chief, Division of Conservation and Classification, U.S. Fish and Wildlife Service at the above address, telephone 703/358–2171 or facsimile 703/358–1735, or Margaret Lorenz, Endangered Species Division, National Marine Fisheries Service at the above address, telephone 301/713–1401 or facsimile 301/713–0376.

SUPPLEMENTARY INFORMATION:

Background

This policy provides direction to Service personnel in determining how to consider a conservation agreement when making a decision on whether a species warrants listing under the Act. It also provides information to the groups interested in developing agreements or plans that would contribute to making it unnecessary for the Services to list a species under the Act.

On June 13, 2000, we published in the **Federal Register** (65 FR 37102) a draft policy for evaluating conservation efforts that have not yet been implemented or have not yet demonstrated effectiveness when making listing decisions under the Act. The policy establishes two basic criteria: (1) The certainty that the conservation efforts will be implemented and (2) the certainty that the efforts will be effective. The policy provides specific factors under these two basic criteria that we will use to direct our analysis of the conservation effort. At the time of making listing determinations, we will evaluate formalized conservation efforts (i.e., conservation efforts identified in a conservation agreement, conservation plan, management plan, or similar document) to determine if the conservation effort provides certainty of implementation and effectiveness and, thereby, improves the status, as defined by the Act, of the species such that it does not meet the Act's definition of a threatened or endangered species.

When we evaluate the certainty of whether the formalized conservation effort will be implemented, we will consider the following: Do we have a high level of certainty that the resources necessary to carry out the conservation effort are available? Do the parties to the conservation effort have the authority to carry it out? Are the regulatory or procedural mechanisms in place to carry out the efforts? And is there a schedule for completing and evaluating the efforts? If the conservation effort relies on voluntary participation, we will evaluate whether the incentives that are included in the conservation effort will ensure the level of participation necessary to carry out the conservation effort. We will also evaluate the certainty that the conservation effort will be effective. In making this evaluation, we will consider the following: Does the effort describe the nature and extent of the threats to the species to be addressed and how these threats are reduced by the conservation effort? Does the effort establish specific conservation objectives? Does the effort identify the appropriate steps to reduce threats to the species? And does the effort include quantifiable performance measures to monitor for both compliance and effectiveness? Overall, we need to be certain that the formalized conservation effort improves the status of the species at the time we make a listing determination.

This policy is important because it gives us a consistent set of criteria to evaluate formalized conservation efforts. For states and other entities that are developing agreements or plans, this policy informs them of the criteria we will use in evaluating formalized conservation efforts when making listing decisions, and thereby guides States and other entities that wish to develop formalized conservation efforts that may contribute to making listing unnecessary.

In the notice of the draft policy, we specifically requested comments on the criteria that we would use to evaluate the certainty that a formalized conservation effort will be implemented. Also, we requested comments on the timing of the development of conservation agreements or plans. We have learned that timing is the most critical element when developing a successful conservation agreement or plan. Encouraging and facilitating early development of conservation agreements or plans is an important objective of this policy. Last-minute agreements (i.e., those that are developed just before or after a species is proposed for listing) often have little chance of affecting the outcome of a listing decision. Once a species is proposed for listing under the Act, we may have insufficient time to include consideration of a newly developed conservation plan in the public notice and comment process and still meet our statutory deadlines. Last-minute efforts are also less likely to be able to demonstrate that they will be implemented and effective in reducing or removing threats to the species. In addition, there are circumstances in which the threats to a species are so imminent and/or complex that it will be almost impossible to develop an agreement or plan that includes conservation efforts that will result in making the listing unnecessary. Accordingly, we encourage the early development of formalized conservation efforts before the threats become too extreme and imminent and when there is greater flexibility in sufficiently improving a species' status to the point where listing the species as threatened or endangered is unnecessary.

Summary of Comments and Recommendations

In response to our request for comments on the draft policy, we received letters from 44 entities. Thirty-five were in support of the policy and nine were against. We reviewed all comments received and have incorporated accepted suggestions or clarifications into the final policy text. Because most of these letters included similar comments (several were form letters) we grouped the comments according to issues. The following is a summary of the relevant comments and our responses. We also received comments that were not relevant to the policy and, therefore, outside the policy's scope. We responded to some of these comments where doing so would clarify the process for determining whether a species is endangered or threatened (the listing process) or clarify the nature of conservation plans, agreements, and efforts.

Policy Scope Issues

Issue 1: Many commenters felt that this policy should also apply to downlisting species from endangered to threatened status and delisting actions, or else parties to an agreement where the final decision is to list the species would not have any incentives to take action on a listed species until a recovery plan is developed. In addition, one commenter suggested that the policy scope should be expanded to include the process of designating critical habitat.

Response 1: We believe that the immediate need is to develop criteria that will guide consistent and predictable evaluation of conservation efforts at the time of a listing determination. We may consider such a policy for downlisting or delisting actions in the future. However, we note that a recovery plan is the appropriate vehicle to provide guidance on actions necessary to delist a species. Also, we may consider developing a similar policy for critical habitat designations.

Issue 2: Two commenters stated that our estimates of time needed to develop, implement, monitor, and report on conservation efforts are underestimated.

Response 2: We agree that our original estimates were too low. We have increased our estimate to an average of 2,500 person-hours to complete a conservation agreement (with a range of 1,000 to 4,000 person-hours). We also increased our estimate of the average number of person-hours to conduct monitoring and to prepare a report to

320 and 80 hours, respectively. We expect the amount of time will vary depending on several factors including, but not limited to, the number of species addressed, amount of biological information available on the species, and the complexity of the threats. Therefore, we have provided an average to assist interested parties in their planning efforts.

Issue 3: One commenter questioned whether we would evaluate proposed agreements or plans using the stated criteria automatically or only upon request. The commenter also questioned whether we will consider agreements or plans that we previously determined were not sufficient to prevent the need for listing in combination with ''new'' proposed agreements or plans when we evaluate whether to list a species.

Response 3: If a listing proposal is under review, we will consider any conservation effort. We will evaluate the status of the species in the context of all factors that affect the species' risk of extinction, including all known conservation efforts whether planned, under way, or fully implemented. However, for formalized conservation efforts not fully implemented, or where the results have not been demonstrated, we will consider the PECE criteria in our evaluation of whether, and to what extent, the formalized conservation efforts affect the species' status under the Act.

Issue 4: One commenter asked the length of time for which a plan is approved.

Response 4: The PECE is not a plan-approval process, nor does it establish an alternative to listing. PECE outlines the criteria we will consider when evaluating formalized conservation efforts that have not yet been fully implemented or do not yet have a record of effectiveness at the time we make a listing decision. Should the status of a species decline after we make a decision not to list this species, we would need to reassess our listing decision. For example, there may be situations where the parties to a plan or agreement meet their commitments, but unexpected and/or increased threats (e.g., disease) may occur that threaten the species' status and make it necessary to list the species.

Issue 5: One commenter asked if the ''new information'' reopener is operative at any time.

Response 5: Yes, because section 4(b)(1) of the Act requires us to use the best available scientific and commercial data whenever making decisions during the listing process. In making a decision whether to list a species, we will take into account all available information, including new information regarding formalized conservation efforts. If we receive new information on a formalized conservation effort that has not yet been implemented or not yet demonstrated effectiveness prior to making a listing decision, we will evaluate the conservation effort in the context of the PECE criteria. If we receive new information on such an effort after we have decided to list a species, then we will consider this new information along with other measures that reduce threats to the species and may use this information in downlisting the species from endangered to threatened status or delisting. However, PECE will not control our analysis of the downlisting of the species.

Issue 6: One commenter stated that it is unrealistic and unreasonable to expect agreements to be in place at the time the conservation effort is evaluated. In addition, the commenter stated that it is particularly unrealistic and unreasonable to expect that conservation agreements or plans be submitted within 60 days of publication of a proposed rule.

Response 6: We strongly encourage parties to initiate formalized conservation efforts prior to publication of a proposal to list a species under the Act. If a formalized conservation effort is submitted during the public comment period for a proposed rule, and may be significant to the listing decision, then we may extend or reopen the comment period to allow time for comment on the new conservation effort. However, we can extend the public comment period only if doing so does not prevent us from completing the final listing action within the statutory timeframe.

Issue 7: One commenter stated that most existing conservation agreements are ineffective, and furthermore that we are unable to determine their effectiveness for several years.

Response 7: We agree that it could take several years for some conservation efforts to demonstrate results. However, the PECE criteria provide the framework for us to evaluate the likely effectiveness of such formalized conservation efforts. Some existing conservation efforts have proven to be very effective and have justifiably influenced our listing decisions.

Issue 8: Several commenters stated that funds are better spent to list species, designate critical habitat, and implement recovery efforts rather than to develop conservation agreements.

Response 8: Conservation agreements can be seen as early recovery efforts. Early conservation efforts to improve the status of a species before listing is necessary may cost less than if the species' status has already been reduced to the point where it needs to be listed. Early conservation of candidate species can reduce threats and stabilize or increase populations sufficiently to allow us to use our resources for species in greater need of the Act's protective measures.

Issue 9: Some commenters questioned the 14 conservation agreements that we cited which contributed to making listing the covered species as threatened or endangered unnecessary. Commenters requested information on each plan to better allow the public to evaluate the adequacy of the agreements.

Response 9: We referenced the 14 conservation agreements in the Paperwork Reduction Act section of the draft policy and used them solely to estimate the information collection and recordkeeping burden that would result from our draft policy if it were made final. Therefore, we do not recommend using these to comment on the new policy.

Biological Issues

Issue 10: One commenter questioned our method for evaluating a conservation plan that addresses only a portion of a species' range.

Response 10: Using the PECE criteria, we will evaluate all formalized conservation efforts that have yet to be implemented or have yet to demonstrate results at the time we make our listing decision. This is true for efforts that are applicable to all or only a portion of the species' range. The PECE does not set standards for how much conservation is needed to make listing unnecessary. The significance of plans that address only a portion of a species' range will be evaluated in the context of the species' overall status. While a formalized conservation effort may be effective in reducing or removing threats in a portion of the species' range, that may or may not be sufficient to remove the need to list the species as threatened or endangered. In some cases, the conservation effort may lead to a determination that a species warrants threatened status rather than endangered.

In addition, parties may have entered into agreements to obtain assurances that no additional commitments or restrictions will be required if the species is listed. A landowner or other non-Federal entity can enter into a Candidate Conservation Agreement with Assurances (CCAA) (64 FR 32726, June 17, 1999), which are formal agreements between us and one or more non-Federal parties that address the conservation needs of proposed or candidate species, or species likely to become candidates. These agreements provide assurances to non-Federal property owners who voluntarily agree to manage their lands or waters to remove threats to candidate or proposed species, or to species likely to become candidates. The assurances are authorized under the CCAA regulations (50 CFR 17. 22(d)(5) and 17.32(d)(5)) and provide non-Federal property owners assurances that their conservation efforts will not result in future regulatory obligations in excess of those they agree to at the time they enter into the Agreement. Should the species eventually be listed under the Act, landowners will not be subjected to increased property use restrictions as long as they conform to the terms of the agreement. While one of these agreements may not remove the need to list, several such agreements, covering a large portion of the species' range, may.

Issue 11: Several commenters suggested that the Services should consider conservation efforts developed for species other than the species for which a listing decision is being made when the species have similar biological requirements and the conservation effort addresses protection of habitat of the species for which a listing decision is being made.

Response 11: We agree. When a decision whether or not to list a species is being made, we will consider all conservation efforts that reduce or remove threats to the species under review, including conservation efforts developed for other species. However, for all formalized conservation efforts that have not yet been implemented or have yet to demonstrate results, we will use the PECE criteria to evaluate the conservation effort for certainty of implementation and effectiveness for the species subject to the listing decision.

Issue 12: One commenter stated the ''biology/natural history'' of the species should be adequately known and explained in order to evaluate the effectiveness of the effort.

Response 12: When we consider the elements under the effectiveness criterion, we will evaluate whether the formalized conservation effort incorporates the best available information on the species' biology and natural history. However, due to variation in the amount of information available about different species and the threats to their existence, the level of information necessary to provide a high level of certainty that the effort will be effective will vary.

We believe it is important, however, to start conservation efforts as early as possible even if complete biological information is lacking. Regardless of the extent of biological information we have about a species, there will almost always be some uncertainty about threats and the most effective mechanisms for improving the status of a species. We will include the extent of gaps in the available information in our evaluation of the level of certainty that the formalized conservation effort will be effective. One method of addressing uncertainty and accommodating new information is the use of monitoring and the application of adaptive management principles. The PECE criteria note that describing the threats and how those threats will be removed, including the use of monitoring and adaptive management principles, as appropriate, is critical to determining that a conservation effort that has yet to demonstrate results has reduced or removed a particular threat to a species.

Issue 13: Several commenters suggested that affected party(ies) should work with the Services to identify species that will be proposed for listing in the near future to help concentrate and direct efforts to those species that most warrant the protection, and help make the party(ies) aware of when and what actions should be taken to help conserve species in need.

Response 13: We do identify species in need of protection. The FWS publishes a Candidate Notice of Review (CNOR) in which the FWS identifies those species of plants and animals for which they have sufficient information on the species' biological status and threats to propose them as endangered or threatened under the Act, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. NMFS, which has jurisdiction over marine species and some anadromous species, defines candidate species more broadly to include species whose status is of concern but more information is needed before they can be proposed for listing. NMFS candidate species can be found on their web site at *http://www.nmfs.noaa.gov*. The FWS's CNOR is published in the **Federal Register** and can also be found on their web site at *http://endangered.fws.gov.*

We agree that it is important to start developing and implementing conservation efforts and coordinating those efforts with us as early as possible. Early conservation helps preserve management options, minimizes the cost of reducing threats to a species, and reduces the potential for land use restrictions in the future. Addressing the needs of species before the regulatory protections associated with listing under the Act come into play often allows greater management flexibility in the actions necessary to stabilize or restore these species and their habitats. Early implementation of conservation efforts may reduce the risk of extinction for some species, thus eliminating the need for them to be listed as threatened or endangered.

Issue 14: One commenter stated that requiring an implementation schedule/timeline for conservation objectives is not feasible when baseline data on a species is poorly understood. The policy should recognize that variation in patterns of species distribution and land ownership will cause variation in the difficulty of developing conservation efforts. Thus, some conservation efforts should be allotted more time for their completion.

Response 14: Biological uncertainty is a common feature of any conservation effort. Nevertheless, some conservation actions can proceed even when information on the species is incomplete. Implementation schedules are an important element of all formalized conservation planning efforts (e.g., recovery plans). The implementation schedule identified in PECE criterion A.8. establishes a timeframe with incremental completion dates for specific tasks. In light of the information gaps that may exist for some species or actions, schedules for completing certain tasks may require revision in response to new information, changing circumstances, and the application of adaptive management principles. Including an implementation schedule in a formalized conservation effort is critical to determining that the effort will be implemented and effective and has improved the status of the species under the Act at the time we make our listing determination.

We acknowledge that the amount of time required to develop and implement formalized conservation efforts will vary. Therefore, we encourage early development and implementation of conservation efforts for species that have not yet become candidates for listing and for those species that are already candidates. This policy does not dictate timeframes for completing conservation efforts. However, the Act mandates specific timeframes for many listing decisions, and we cannot delay final listing actions to allow for the development and signing of a conservation agreement or plan. We and participants must also acknowledge that, for species that are poorly known, or whose threats are not well understood, it is unlikely that conservation efforts that have not been implemented or that have yet to yield results will have improved the status of the species sufficiently to play a significant role in the listing decision.

Issue 15: One commenter stated that the Services, when evaluating the certainty of conservation efforts while making listing decisions, should factor into the analysis the Services' ability to open or reopen the listing process at any time, and to list the species on an emergency basis if necessary.

Response 15: We will initiate or revisit a listing decision if information indicates that doing so is warranted, and on an emergency basis if there is an imminent threat to the species' well-being. However, we do not make any listing determinations based on our ability to change our decisions. We base our listing decisions on the status of the species at that time, not on some time in the future.

Criteria Issues

Issue 16: Several commenters requested that we further explain the criteria for both implementation and effectiveness. The commenters claim that our criteria are too vague and are subject to interpretation by the Services. One commenter said that, by stating ''this list should not be considered comprehensive evaluation criteria,'' the policy allows the Services to consider criteria not addressed in the agreement, and allows for too much leeway for the Services to reject conservation efforts of an agreement, even if all criteria listed in the draft policy are satisfied.

Response 16: PECE establishes a set of criteria for us to consider when evaluating formalized conservation efforts that have not yet been implemented or have not yet demonstrated effectiveness to determine if the efforts have improved the status of the species. At the time of the listing decision, we must find, with minimal uncertainty, that a particular formalized conservation effort will be implemented and will be effective, in order to find that the effort has positively affected the conservation status of a species. Meeting these criteria does not create an approval process. Some conservation efforts will address these criteria more thoroughly than others. Because, in part, circumstances vary greatly among species, we must evaluate all conservation efforts on a case-by-case basis at the time of listing, taking into account any and all factors relevant to whether the conservation effort will be implemented and effective.

Similarly, the list of criteria is not comprehensive because the conservation needs of species will vary greatly and depend on species-specific, habitat-specific, location-specific, and action-specific factors. Because conservation needs vary, it is not possible to state all of the factors that might determine the ultimate effectiveness of formalized conservation efforts. The species-specific circumstances will also determine the amount of information necessary to satisfy these criteria. Evaluating the certainty of the effectiveness of a formalized conservation effort necessarily includes an evaluation of the technical adequacy of the effort. For example, the effectiveness of creating a wetland for species conservation will depend on soil texture, hydrology, water chemistry, and other factors. Listing all of the factors that we would appropriately consider in evaluations of technical adequacy is not possible.

Issue 17: One commenter suggested that we consider conservation plans in the development stage rather than waiting until finalized due to the possible benefits that may result from initial efforts.

Response 17: Plans that have not been finalized and, therefore, do not conform to the PECE criteria, may have some conservation value for the species. For example, in the process of developing a plan, participants and the public may become more informed about the species and its conservation needs. We will consider any benefits to a species that have accrued prior to the completion of an agreement or plan in our listing decision, under section 4(b)(1)(A) of the Act. However, the mere existence of a planning process does not provide sufficient certainty to actually improve the status of a species. The criteria of PECE set a rigorous standard for analysis and assure a high level of certainty associated with formalized conservation efforts that have not been implemented, or have yet to yield results, in order to determine that the status of the species has improved.

We encourage parties to involve the appropriate Service during the development stage of all conservation plans, whether or not they are finalized prior to a listing decision. Sharing of the best available information can lead to developing better agreements. In the event that the focus species is listed, these planning efforts can be utilized as the basis for development of Safe Harbor Agreements or Habitat Conservation Plans, through which we can permit incidental take under Section 10(a) of the Act, or provide a basis for a recovery plan.

Issue 18: Several commenters stated that the policy should provide more sufficient, clear criteria by which the implementation and effectiveness of conservation efforts is monitored and assessed. One commenter also suggested that we require a specific reporting format to help show effectiveness of conservation efforts.

Response 18: When evaluating formalized conservation efforts under PECE, we will consider whether the effort contains provisions for monitoring and reporting implementation and effectiveness results (see criterion B.5).

Regarding a standard reporting format, the nature of the formalized conservation efforts we evaluate will probably vary a great deal. Efforts may range from complex to single-threat approaches. Therefore, for us to adopt a one-size-fits-all approach to report on monitoring efforts and results would be inappropriate.

Issue 19: One commenter stated that PECE is too demanding with respect to identification and commitment of resources ''up-front,'' and that these strict requirements and commitments on conservation efforts harm the voluntary nature of agreements.

Response 19: Addressing the resources necessary to carry out a conservation effort is central to establishing certainty of plan implementation and effectiveness. Accordingly, we believe that PECE must establish a minimum standard to assure certainty of implementation and effectiveness. This certainty is necessary in determining whether the conservation effort has improved the status of species.

It is our intention and belief that the PECE criteria will actually increase the voluntary participation in conservation agreements by increasing the likelihood that parties' voluntary efforts and commitments that have yet to be implemented or have yet to demonstrate results will play a role in a listing decision.

Issues Related to Specific Changes

Several commenters recommended specific changes to the evaluation criteria. The recommended additions in language to the criteria are italicized and deletions are shown in strikeout to help the reader identify the proposed changes.

Issue 20: Commenters stated that there is potential confusion between evaluation criteria A.2. (authority) and A.3.(authorization) as they believed some Service staff may have difficulty distinguishing between an ''authority,'' and an ''authorization.'' To help eliminate this potential confusion, commenters requested that criterion A.2. be changed to read: ''the legal authority of the party(ies) to the agreement or plan to implement the conservation effort and the legal procedural requirements necessary to implement the effort are described.'' They also requested that we change criterion A.3. to read: The legal requirements (e.g. permits, environmental review documents) necessary to implement the conservation effort are identified, and an explanation of how the party(ies) to the agreement or plan that will implement the effort will fulfill these requirements is provided.''

Response 20: We agree with adding the word ''legal'' and also have incorporated additional language and separated this criterion (former criterion A.2) into two criteria (A.2. and A.3.). Evaluation Criterion A.2. now reads, ''The legal authority of the party(ies) to the agreement or plan to implement the formalized conservation effort, and the commitment to proceed with the conservation effort are described.'' New evaluation Criterion A.3. reads, ''The legal procedural requirements necessary to implement the effort are described, and information is provided indicating that fulfillment of these requirements does not preclude commitment to the effort.'' In making these changes, we recognize that there may be overlap between new criterion A.3. and the criterion on authorizations (now A.4.), but our intent is to separate a criterion on procedural requirements from substantive authorizations (e.g. permits). We believe that we need to specifically determine that the parties to the agreement will obtain the necessary authorizations. We also recognize that parties may not be able to commit to some conservation efforts until they have fulfilled procedural requirements (e.g. under the National Environmental Policy Act) since some laws preclude commitment to a specific action until certain procedures are completed. Additionally, in creating a new criterion A.3., we find it unnecessary to incorporate the suggested changes to old A.3. (now A.4.).

Issue 21: Commenters requested the following change to Criterion A.4. (now Criterion A.5.): ''The level of voluntary participation (e.g., permission to enter private land or other contributions by private landowners) necessary to implement the conservation effort is identified, and an explanation of how the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation is provided (e.g., an explanation of why incentives to be provided are expected to result in the necessary level of voluntary participation)''.

Response 21: We do not believe that including ''an explanation of how the party(ies) * * * will obtain that level of voluntary participation * * *'' will provide us with enough information in order to determine that necessary voluntary participation will, in fact, be obtained. Evaluation Criterion A.5. (formerly A.4.) now reads: ''The type and level of voluntary participation (e.g., number of landowners allowing entry to their land, or number of participants agreeing to change timber management practices and acreage involved) necessary to implement the conservation effort is identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation (e.g., an explanation of how incentives to be provided will result in the necessary level of voluntary participation).''

Issue 22: Commenters suggested that Evaluation Criterion A.5. (now criterion A.6.) be changed to read as ''Any statutory or regulatory deficiency or barrier to implementation of the conservation effort is identified and an explanation of how the party(ies) to the agreement or plan that will implement the effort will resolve the deficiency or barriers is provided.''

Response 22: We do not agree with the suggested language change. We believe that all regulatory mechanisms, including statutory authorities, must be in place to ensure a high level of certainty that the conservation effort will be implemented.

Issue 23: The suggested change to Evaluation Criterion A.6. (now A.7.) is ''A fiscal schedule and plan is provided for the conservation effort, including a description of the obligations of party(ies) to the agreement or plan that will implement the conservation effort, and an explanation of how they will obtain the necessary funding is provided.''

Response 23: We do not agree with the suggested language change since we believe that there must be a high level of certainty that the party(ies) will obtain the necessary funding to implement the effort. While we agree that including a fiscal schedule, a description of the obligations of the party(ies), and an explanation of how they will obtain the funding is important, this information, by itself, does not provide enough certainty for us to consider a formalized conservation effort that has not yet been implemented as contributing to a listing decision. Also see our response to Issue 41.

Issue 24: One commenter suggested that the Services should consider an incremental approach to evaluating implementation dates for the conservation effort.

Response 24: We agree with the commenter's suggested change. Evaluation Criterion A.8. (formerly A.7.) now reads as: ''An implementation schedule (including incremental completion dates) for the conservation effort is provided.''

Issue 25: Commenters suggested that Criterion A.8. (now A.9.) be revised to read: ''The conservation agreement or plan that includes the conservation effort include a commitment by the party(ies) to apply their legal authorities and available resources as provided in the agreement or plan.''

Response 25: The participation of the parties through a written agreement or plan establishes each party's commitment to apply their authorities and resources to implementation of each conservation effort. Therefore, it is unnecessary to include the suggested language; criterion A.9. (formerly A.8.) remains unchanged.

Issue 26: A commenter also suggested adding a criterion: ''Evidence that other conservation efforts have been implemented for sympatric species within the same ecosystem that may provide benefits to the subject species is provided.''

Response 26: We do not think it is necessary to add such a criterion. At the time of listing, we will take into consideration all relevant information, including the effect of other conservation efforts for sympatric species on the status of the species we are considering for listing.

Issue 27: Several commenters recommended that we make specific changes to the Criterion B.1. language to read as: ''The nature and extent of threats being addressed by the conservation effort are described, and how the conservation effort will reduce the threats are defined.'' In addition, commenters suggested we change Criterion B.2. to read as: ''Explicit incremental objectives for the conservation effort and dates for achieving them should be stated.''

Response 27: We agree that, in addition to identifying threats, the plan should explain how formalized conservation efforts reduce threats to the species. Therefore, Evaluation Criterion B.1. now reads as: ''The nature and extent of threats being addressed by the conservation effort are described, and how the conservation effort reduces the threats is described.'' We agree that conservation efforts should include incremental objectives. This allows the parties to evaluate progress toward the overall goal of a conservation effort, which is essential for adaptive management. In addition, setting and achieving interim objectives is helpful in maintaining support for the effort. Therefore, Evaluation Criterion B.2. now reads as: ''Explicit incremental objectives for the conservation effort and dates for achieving them are stated.''

Issue 28: Some commenters recommended that the party's (ies') prior record with respect to development and implementation of conservation efforts be recognized towards their credibility and reliability to implement future conservation efforts. A commenter also suggested adding a criterion to read as: ''Demonstrated ability of the party(ies) to develop and implement effective conservation efforts for this or other species and habitats.'' Another comment suggested that the history and momentum of a program should be taken into account (e.g., watershed council programs) when considering the certainty of effectiveness and implementation. These considerations would help ensure a high level of certainty that regulatory mechanisms, funding authorizations, and voluntary participation will be adopted by a specified date adequate to provide certainty of implementation.

Response 28: Although it would be beneficial for the party(ies) to demonstrate their past abilities to implement effective formalized conservation efforts for the focus species or other species and habitats, we do not believe that this is necessary to demonstrate a high level of certainty that the conservation effort will be implemented. In addition, a criterion that emphasizes previous experience in implementing conservation efforts may limit formalized conservation efforts to only those party(ies) that have a track record and would unjustifiably constrain consideration of efforts by those who do not satisfy this criterion. Such parties can provide certainty in other ways. We agree that a party's (ies') prior record and history with respect to implementation of conservation efforts should be recognized towards their credibility and reliability. Information concerning a party's experience in implementing conservation efforts may be useful in evaluating how their conservation effort satisfies the PECE criteria. The momentum of a project is a good indication of the progress that is being made towards a party's (ies') conservation efforts, but momentum can decrease, and thus cannot be solely relied upon to determine the certainty that a formalized conservation effort will be implemented or effective.

Issue 29: One commenter stated that our use of ''must'' in meeting the criteria is inappropriate in the context of a policy, and the policy should rather be treated as guidance.

Response 29: The only mandatory statements in the policy refer to findings that we must make. In order for us to find that a particular formalized conservation effort has improved the status of the species, we must be certain that the formalized conservation effort will be implemented and will be effective. No party is required to take any action under this policy. Rather the policy provides us guidance on how we will evaluate formalized conservation efforts that have yet to be implemented or have yet to demonstrate effectiveness at the time of our listing decision.

Legal Issues

Issue 30: Many commenters mentioned past litigation (i.e., decisions on coho salmon and Barton Springs salamander) in which the courts have ruled against the Services in cases that have involved Candidate Conservation Agreements or other conservation efforts, and question how the PECE policy addresses this issue. Commenters question how this policy will keep the Services from relying on speculative conservation efforts.

Response 30: We referenced past adverse decisions when we published the draft policy. The purpose of PECE, in part, is to address situations similar to those in which some courts found past conservation efforts insufficient. We developed the PECE to establish a set of consistent standards for evaluating certain formalized conservation efforts at the time of a listing decision and to ensure with a high level of certainty that formalized conservation efforts will be implemented and effective. We agree that we may not rely on speculative promises of future action when making listing decisions.

Issue 31: Several commenters questioned the legality of considering private party's (ies') input when section 4(b)(1)(A) of the Act states ''* * * and after taking into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *'' In addition, commenters stated that the PECE policy is inconsistent with the plain language and the congressional intent of the Act by allowing agencies to evaluate any private measures. They also stated that this was inconsistent with considering section 4(a)(1)(D), which only permits agencies to evaluate ''existing regulatory mechanisms.'' They also stated that the Services incorrectly conclude that section 4(a)(1)(E), ''other natural or manmade factors affecting [the species'] continued existence,'' allows the Services to consider actions of ''any other entity'' in making listing determinations. One commenter stated that there are no provisions to authorize the Services to consider voluntary conservation agreements by other Federal agencies. In 1982, the Act omitted 1973 language for listing determinations made with ''other interested Federal agencies.'' In addition, the commenters stated that the Act imposes conservation duties on all Federal agencies only after the Services have taken the initial step in listing the species.

Response 31: Please refer to the Policy Scope section for an explanation of our authority under section 4 of the Act to assess all threats affecting the species status as well as all efforts that reduce threats to the species.

Issue 32: One commenter suggested that we formalize this policy by codifying it in the Code of Federal Regulations. They suggest that by adopting this policy as agency regulation, we can make the policy more binding, provide a basis for judicial deference, and thus hopefully reduce the amount of litigation.

Response 32: We believe that codifying PECE in the Code of Federal Regulations is not necessary because it is intended as a policy to guide how we will evaluate formalized conservation efforts when making listing decisions.

Issue 33: Some commenters believe that all regulatory mechanisms must be in place prior to finalizing a conservation plan, while other commenters feel that this requirement may dissuade voluntary conservation efforts of private landowners. One commenter stated that, based on the amount of time usually needed to enact most regulatory mechanisms, it seems appropriate to set this minimum standard for evaluating formalized conservation efforts. This criterion should prompt more serious political consideration of adopting a regulatory mechanism sooner rather than later. Another commenter suggested that, instead of requiring regulations, we should require cooperators to identify and address any regulatory deficiencies affecting the species.

Response 33: In order for us to determine with a high level of certainty that a formalized conservation effort will be implemented, among other things, all regulatory mechanisms necessary to implement the effort must be in place at the time we make our listing decision. However, there may be situations where regulatory mechanisms are not necessary for implementing the conservation effort due to the nature of the action that removes threats, or there may be situations where necessary regulatory mechanisms are already in place.

Issue 34: One commenter stated that only when an alternative regulatory mechanism provides the same or higher protections than listing can the threat factors be said to be alleviated. A high level of certainty over future funding or voluntary participation might be acceptable if alternative regulatory mechanisms to prevent take in the interim are in place.

Response 34: Determinations to list species under the Act are based solely on whether or not they meet the definitions of threatened or endangered as specified by the Act. Through PECE, we will evaluate, at the time of our listing decision, whether a formalized conservation effort adequately reduces threats and improves the status of the species to make listing unnecessary. Additional alternative regulatory mechanisms to prevent take are not necessary if the threats to the species are reduced to the point that the species does not meet the definitions of threatened or endangered.

Issue 35: One commenter stated concern that the Services would not be able to provide assurances to private landowners because no specific provisions in the Act authorize conservation agreements in lieu of listing, and that third party lawsuits also undermine the Services' assurances. One commenter asked what future protection of their ongoing actions participants would receive.

Response 35: Satisfying the PECE criteria does not provide assurances that we will not decide to list a species. Also, because of the individual nature of species and the circumstances of their status, PECE does not address how much conservation is required to make listing unnecessary. Because of the numerous factors that affect a species' status, we may list a species despite the fact that one or more formalized conservation efforts have satisfied PECE. However, assurances can be provided to non-Federal entities through an approved Candidate Conservation Agreement with Assurances (CCAA) and in an associated enhancement of survival permit issued under section 10(a)(1)(A) of the Act. Many property owners desire certainty with regard to future regulatory restrictions to guarantee continuation of existing land or water uses or to assure allowance for future changes in land use. By facilitating this kind of individual land use planning, assurances provided under the CCAA policy can substantially benefit many property owners. These agreements can have significance in our listing decisions, and we may also evaluate them according to the criteria in the PECE if they are not yet implemented or have not demonstrated results. However, we will make the determination of whether these CCAAs preclude or remove any need to list the covered species on a case-by-case basis in accordance with the listing criteria and procedures under section 4 of the Act.

Issue 36: Several commenters stated that the PECE does not always provide incentives to conserve species and is, therefore, not supported by the Congressional finding of section 2(a)(5) of the Act. The commenters stated that the parties lack incentives to develop conservation programs until after the species is listed (e.g., *Building Industry Association of Southern California* v. *Babbitt*, where listing the coastal California gnatcatcher encouraged enrollment in conservation programs.) In addition, they stated that PECE provides a means for the listing process to be avoided entirely, and, therefore, may often fail to provide incentives that Congress referred to in its findings in section 2(a)(5). They stated that the ''system'' of incentives to which that Congressional finding refers is already found in incidental take provisions in section 10 of the Act, which will better ensure development and implementation of successful conservation programs.

Response 36: PECE is not ''a way to avoid listing'' or an ''in lieu of listing'' policy. This policy outlines guidance on the criteria we will use to evaluate formalized conservation efforts in determining whether to list a species. Knowing how we will evaluate any unimplemented or unmeasured formalized conservation efforts may help parties draft more effective agreements. However, there is a conservation incentive because, if a species becomes listed, these efforts can contribute to recovery and eventual delisting or downlisting of the species. Also, see our response to Issue 35.

Issue 37: Several commenters stated that relying on unimplemented future conservation measures is inconsistent with the definitions of ''threatened species'' and ''endangered species'' as provided in section 3 of the Act, and that PECE's evaluation of future, unimplemented conservation efforts in listing determinations is inconsistent with both the plain language of the Act and Congressional intent. Also, the commenters stated that the PECE erroneously claims that the definitions of ''threatened species'' and ''endangered species'' connote future status, not present status.

Response 37: We agree that, when we make a listing decision, we must determine the species' present status which includes, in part, an evaluation of current threats. However, deciding or determining whether a species meets the definition of threatened or endangered also requires us to make a prediction about the future persistence of a species. Central to this concept is a prediction of future conditions, including consideration of future negative effects of anticipated human actions. The language of the Act supports this approach. The definitions for both ''endangered species'' and ''threatened species'' connote future condition, which indicates that consideration of whether a species should be listed depends in part on identification and evaluation of future actions that will reduce or remove, as well as create or exacerbate, threats to the species. We cannot protect species without taking into account future threats to a species. The Act does not require that, and species conservation would be compromised if, we wait until a threat is actually impacting populations before we list the species as threatened or endangered. Similarly, the magnitude and/or imminence of a threat may be reduced as a result of future positive human actions. Common to the consideration of both the negative and positive effects of future human actions is a determination of the likelihood that the actions will occur and that their effects on the species will be realized. Therefore, we consider both future negative and future positive impacts when assessing the listing status of the species. The first factor in section 4(a)(1)—''the present or threatened destruction, modification, or curtailment of [the species'] habitat or range''—identifies how analysis of both current actions affecting a species' habitat or range and those actions that are sufficiently certain to occur in the future and affect a species' habitat or range are necessary to assess a species' status. However, future Federal, state, local, or private actions that affect a species are not limited to actions that will affect a species' habitat or range. Congress did not intend for us to consider future actions affecting a species' habitat or range, yet ignore future actions that will influence overutilization, disease, predation, regulatory mechanisms, or other natural or manmade factors. Therefore, we construe Congress' intent, as reflected by the language of the Act, to require us to consider both current actions that affect a species' status and sufficiently certain future actions—either positive or negative—that affect a species' status.

Issue 38: Several commenters stated that PECE's ''sufficient certainty'' standard is inconsistent with the Act's ''best available science'' standard. They stated that courts have ruled that any standard other than ''best available science'' violates the plain language and the Congressional intent of the Act. The commenters also stated that the ''sufficient certainty'' standard violates Congressional intent because it weakens the standard required by the Act to list species and can result in unnecessary, and potentially harmful, postponement of affirmative listing.

Response 38: We agree that our listing decisions must be based on the best available science. PECE does not address or change the listing criteria and procedures established under section 4 of the Act. Listing analyses include the evaluation of conservation efforts for the species under consideration. PECE is designed to help ensure a consistent and rigorous review of formalized conservation efforts that have yet to be implemented or efforts that have been implemented but have not yet shown effectiveness by establishing a set of standards to evaluate the certainty of implementation and effectiveness of these efforts.

Issue 39: Several commenters stated that PECE reduces or eliminates public comment on proposed rules to list species and is in violation of the Administrative Procedure Act (APA). Further, they stated that PECE violates the APA by allowing submission of formalized conservation measures after the proposed rule is issued to list species as threatened or endangered. Receiving ''conservation agreements or plans before the end of the comment period in order to be considered in final listing decision'' encourages landowners to submit conservation agreements at the last minute to avoid public scrutiny, and the PECE process could be a potential delay tactic used by landowners to postpone the listing of species. They stated that the Courts agree that failure of the Services to make available to the public conservation agreements on which listing decisions are based violates the public comment provision of the APA.

Response 39: All listing decisions, including those involving formalized conservation agreements, will comply with the requirements of the APA and ESA. If we receive a formalized conservation agreement or plan during an open comment period and it presents significant new information relevant to the listing decision, we would either extend or reopen the public comment period to solicit public comments specifically addressing that plan or agreement. We recognize, however, that there may be situations where APA requirements must be reconciled with the ESA's statutory deadlines.

Issue 40: Several commenters expressed their concern that conservation efforts do not have binding obligations.

Response 40: While PECE does not require participants to have binding obligations, the policy does require a high level of certainty that a conservation effort will be implemented and effective at the time we make our listing decision. Furthermore, any subsequent failure to satisfy one or more PECE criteria would constitute new information and, depending on the significance of the formalized conservation effort to the species' status, may require a reevaluation of whether there is an increased risk of extinction, and whether that increased risk indicates that the species' status is threatened or endangered.

Funding Issues

Issue 41: Several commenters requested that we further specify our criteria stating that ''a high level of certainty that the party(ies) to the agreement or plan that will implement the conservation effort will obtain the necessary funding is provided.'' In addition, one commenter questioned whether ''a high level of certainty'' for authorizations or funding was really an improvement over the status quo and suggested that we either list the required elements we will use to evaluate completeness of the conservation efforts or quantitatively define an evaluation standard.

Response 41: A high level of certainty of funding does not mean that funding must be in place now for implementation of the entire plan, but rather, it means that we must have convincing information that funding will be provided each year to implement relevant conservation efforts. We believe that at least 1 year of funding should be assured, and we should have documentation that demonstrates a commitment to obtain future funding, e.g., documentation showing funding for the first year is in place and a written commitment from the senior official of a state agency or organization to request or provide necessary funding in subsequent budget cycles, or documentation showing that funds are available through appropriations to existing programs and the implementation of this plan is a priority for these programs. A fiscal schedule or plan showing clear links to the implementation schedule should be provided, as well as an explanation of how the party(ies) will obtain future necessary funding. It is also beneficial for entities to demonstrate that similar funding was requested and obtained in the past since this funding history can show the likelihood that future funding will be obtained.

Issue 42: One commenter suggested that the PECE policy holds qualifying conservation efforts to a higher standard than recovery plans. The commenter quoted several existing recovery plans that included disclaimers about budget commitments associated with specific tasks. Therefore, the commenter concluded that it is unrealistic and unreasonable to mandate that funding be in place when a conservation effort is evaluated.

Response 42: The Act does not require that certainty of implementation be provided for recovery management actions for listed species or conservation efforts for nonlisted species. Likewise, the PECE does not require that certainty of implementation be provided for during development of conservation efforts for nonlisted species. It is inappropriate to consider the PECE as holding conservation plans or agreements to a higher standard than the standard that exists for recovery plans because the PECE does not mandate a standard for conservation plans or agreements at the time of plan development. Rather, the PECE provides us guidance for the evaluation of conservation efforts when making a listing decision for a nonlisted species.

Recovery plans for listed species and conservation plans or agreements for nonlisted species identify needed conservation actions but may or may not provide certainty that the actions will be implemented or effective. However, when making a listing decision for nonlisted species, we must consider the certainty that a conservation effort will be implemented and effective. The PECE establishes criteria for us to use in evaluating conservation efforts when making listing decisions.

It is possible that we would evaluate a management action identified in a recovery plan for a listed species using the PECE. If, for example, a yet-to-be-implemented task identified in a recovery plan for a listed species would also benefit a nonlisted species, we, in making a listing decision for the nonlisted species, would apply the PECE criteria to that task to determine whether it could be considered as contributing to a decision not to list the species or to list the species as threatened rather than endangered. In this situation, we would evaluate the management task identified in a recovery plan using the PECE criteria in the same way as other conservation efforts for the nonlisted species. That is, the recovery plan task would be held to the same evaluation standard in the listing decision as other conservation efforts.

Foreign Species Issues

Issue 43: One commenter asked why the proposed policy excluded conservation efforts by foreign governments, even though section 4(b)(1)(A) of the Act requires the Services to take such efforts into account. This commenter also stated that the proposed policy is contrary to ''The Foreign Relations Law of the United States,'' which he argues requires the United States to defer to other nations when they have a ''clearly greater interest'' regarding policies or regulations being considered by the United States that could negatively affect their nations.

Response 43: As required by the Act, we have taken and will continue to take into account conservation efforts by foreign countries when considering listing of foreign species (sections 4(b) and 8 of the Act). Furthermore, whenever a species whose range occurs at least in part outside of the United States is proposed for a listing action (listing, change in status, or delisting), we communicate with and solicit the input of the countries within the range of the species. At that time, countries are provided the opportunity to share information on the status of the species, management of the species, and on conservation efforts within the foreign country. We will take those comments and information provided into consideration when evaluating the listing action, which by law must follow the analysis outlined in sections 4(a) and 4(b) of the Act. Thus, all listing decisions for foreign species will continue to comply with the provisions of the Act.

Issues Outside Scope of Policy

We received several comments that were outside of the scope of PECE. Below, we have briefly addressed these comments.

Issue 44: A comment was made that the Services should not list foreign species under the Act when such listing is in conflict with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Response 44: Considerations regarding CITES are outside the scope of the PECE. However, we do not believe there is a conflict with CITES and listing of a foreign species under the Act. When evaluating the status of foreign species under the Act, we take into consideration whether the species is listed under CITES (and if listed, at what level) and all available information regarding the listing. If you have questions regarding CITES, please contact the FWS Division of Scientific Authority at 4401 N. Fairfax Drive, Room 750, Arlington, VA 22203 or by telephone at 703–358–1708.

Issue 45: One commenter stated that all conservation agreements/plans should be subject to independent scientific peer review. This commenter also argued that any conservation agreement or plan for a candidate species should remove all known major threats for the species and convey a reasonably high certainty that the agreement or plan will result in full conservation of the species.

Response 45: We believe that scientific review can help ensure that formalized conservation efforts are comprehensive and effective, and we expect that most or all participants will seek scientific review, but we will not require a formal independent peer review of conservation plans at the time of development. If a formalized conservation plan is presented for a species that has been proposed for listing, all relevant information, including formalized conservation efforts, will be subject to independent scientific review consistent with our policy on peer review (59 FR 34270). We will also solicit public comments on our listing proposals.

The amount or level of conservation proposed in a conservation plan (e.g., removal of all versus some of the major threats) is outside the scope of PECE. Assuming that all of the PECE criteria have been satisfied for the efforts to which they apply, it stands to reason that plans that comprehensively address threats are likely to be more influential in listing decisions than plans that do not thoroughly address the conservation of the species. We believe that by establishing the PECE criteria for certainty of implementation and effectiveness, we are promoting the development of plans that improve the status of species. We expect that in some cases this improvement will reduce the risk of extinction sufficiently to make listing under the Act unnecessary, to result in listing a species as threatened rather than endangered, or to make classifying a species as a candidate for listing unnecessary.

Issue 46: Several commenters questioned the extent of state involvement in the development of conservation efforts. One commenter said that the policy should mandate that States be involved with plan development, and that states approve all conservation efforts.

Response 46: It is outside the scope of PECE to establish standards to determine who participates in the development of conservation efforts and at what level. In many cases, states play a crucial role in the conservation of species. For formalized conservation efforts to be effective, it is logical for the states to play an integral role. To that end, we highly encourage state participation to help ensure the conservation of the species, but we do not believe that states should be mandated to participate in the development of all conservation plans. In some cases, states may not have the resources to participate in these plans, and in other situations, individuals or non-state entities may have the ability to develop an effective and well-implemented plan that does not require state participation, but that contributes to the conservation of a species. Through our listing process, we will work with state conservation agencies, and, if the listing decision involves a public comment period, states have a formal opportunity to comment on any conservation efforts being considered in the listing decision.

Issue 47: Several comments were made regarding the feedback mechanisms to correct a party's (ies') inadequate or ineffective implementation of a conservation effort. It was suggested that the Services specify clearly, and based on scientific information, those factors which the Services believe indicate that a conservation effort is either not being implemented or not being effective. Comments also suggested that party(ies) be given reasonable time (e.g., 90–120 days) to respond to the Service's findings by either implementing actions, achieving objectives, or providing information to respond to the Services.

Response 47: PECE is not a regulatory approval process, and establishing a formal feedback mechanism between the Services and participants is not within the scope of PECE. The final determination whether to list a species under the Act will rest solely upon whether or not the species under consideration meets the definition of threatened or endangered as specified by the Act, which will include consideration of whether formalized conservation efforts that meet PECE criteria have enhanced the status of the species. We will provide guidance to improve conservation efforts when possible, but we cannot delay listing decisions in order to participate in a corrective review process when the best scientific and commercial data indicate that a species meets the definition of threatened or endangered.

Issue 48: One commenter requested that we clarify how significant the conservation agreement must be to the species, and describe the anticipated overall impact/importance to the species and the estimated extent of the species' overall range that the habitat conservation agreement might cover.

Response 48: PECE does not establish standards for how much or what kind of conservation is required to make listing a species under the Act unnecessary. We believe that high-quality formalized conservation efforts should explain in detail the impact and significance of the effort on the target species. However, at the time of our listing decision, we will evaluate formalized conservation efforts using PECE to determine whether the effort provides certainty of implementation and effectiveness and improves the status of the species. Through our listing process, we will determine whether or not a species meets the definition of threatened or endangered.

Issue 49: Several commenters wrote that states do not have additional resources to be pro-active on candidate conservation efforts, and suggested that funding for conservation plans or efforts should be provided by the Federal Government.

Response 49: This comment is outside the scope of the PECE. This policy establishes a set of standards for evaluating formalized conservation efforts in our listing decisions and does not address funding sources to develop and implement these efforts.

Summary of Changes From the Proposed Policy

We have slightly revised some of the evaluation criteria as written in the proposed policy. We made the following changes to reflect comments that we received during the public comment period. We added the word ''legal'' to criterion A.2., incorporated additional language (''the commitment to proceed with the conservation effort is described.''), and separated this criterion into two criteria (A.2. and A.3.). We revised criterion A.3. (formerly part of A.2.) to recognize that parties cannot commit to completing some legal procedural requirements (e.g. National Environmental Policy Act) since some procedural requirements preclude commitment to a proposed action before the procedures are actually completed. We changed criterion A.5. (formerly A.4.) by adding ''type'' and ''(e.g., number of landowners allowing entry to their land, or number of participants agreeing to change timber management practices and acreage involved)'' and by replacing ''why'' with ''how'' and ''are expected to'' with ''will.'' We deleted the word ''all'' at the beginning of criterion A.6. as we felt it was redundant. We added ''(including incremental completion dates)'' to criterion A.8. (formerly A.7.). To criterion B.1. we added ''and how the conservation effort reduces the threats is described.''

Also in the proposed policy we stated that if we make a decision not to list a species, or to list the species as threatened rather than endangered, based in part on the contributions of a formalized conservation effort, we will monitor the status of the species. We have clarified this in the final policy to state that we will monitor the status of the effort, including the progress of implementation of the formalized conservation effort.

Required Determinations

Regulatory Planning and Review

In accordance with Executive Order 12866, this document is a significant policy and was reviewed by the Office of Management and Budget (OMB) in accordance with the four criteria discussed below.

(a) This policy will not have an annual economic effect of $100 million or more or adversely affect an economic sector, productivity, jobs, the environment, or other units of government. The policy for the evaluation of conservation efforts when making listing decisions does not pertain to commercial products or activities or anything traded in the marketplace.

(b) This policy is not expected to create inconsistencies with other agencies' actions. FWS and NMFS are responsible for carrying out the Act.

(c) This policy is not expected to significantly affect entitlements, grants, user fees, loan programs, or the rights and obligations of their recipients.

(d) OMB has determined that this policy may raise novel legal or policy issues and, as a result, this action has undergone OMB review.

Regulatory Flexibility Act (5 U.S.C. 601 et seq.)

Under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996), whenever an agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions), unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.

SBREFA amended the Regulatory Flexibility Act to require Federal agencies to provide the statement of the factual basis for certifying that a rule will not have a significant economic impact on a substantial number of small entities. The following discussion explains our determination.

We have examined this policy's potential effects on small entities as required by the Regulatory Flexibility Act and have determined that this action will not have a significant economic impact on a substantial number of small entities since the policy will not result in any significant additional expenditures by entities that develop formalized conservation efforts. The criteria in this policy describe how we will evaluate elements that are already included in conservation efforts and do not establish any new implementation burdens. Therefore, we believe that no economic effects on States and other entities will result from compliance with the criteria in this policy.

Pursuant to the Regulatory Flexibility Act, at the proposed policy stage, we certified to the Small Business Administration that this policy would not have a significant economic impact on a substantial number of small entities, since we expect that this policy will not result in any significant additional expenditures by entities that develop formalized conservation efforts. We received no comments regarding the economic impacts of this policy on small entities. Thus, we certify that this final policy will not have a significant adverse impact on a substantial number of small entities and conclude that a regulatory flexibility analysis is not necessary.

We have determined that this policy will not cause (a) any effect on the economy of $100 million or more, (b) any increases in costs or prices for consumers; individual industries; Federal, State, or local government agencies; or geographical regions, or (c) any significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprises to compete with foreign-based enterprises (see Economic Analysis below).

Executive Order 13211

On May 18, 2001, the President issued an Executive Order (E.O. 13211) on regulations that significantly affect energy supply, distribution, and use. Executive Order 13211 requires agencies to prepare Statements of Energy Effects when undertaking certain actions. Although this policy is a significant action under Executive Order 12866, it is not expected to significantly affect energy supplies, distribution, or use. Therefore, this action is not a significant energy action and no Statement of Energy Effects is required.

Unfunded Mandates Reform Act (2 U.S.C. 1501 et seq.)

In accordance with the Unfunded Mandates Reform Act (2 U.S.C. 1501 *et seq.*):

(a) This policy will not ''significantly or uniquely'' affect small governments. A Small Government Agency Plan is not required. We expect that this policy will not result in any significant additional expenditures by entities that develop formalized conservation efforts.

(b) This policy will not produce a Federal mandate on state, local, or tribal governments or the private sector of $100 million or greater in any year; that is, it is not a ''significant regulatory action'' under the Unfunded Mandates Reform Act. This policy imposes no obligations on state, local, or tribal governments (see Economic Analysis below).

Takings

In accordance with Executive Order 12630, this policy does not have significant takings implications. While state, local or Tribal governments, or private entities may choose to directly or indirectly implement actions that may have property implications, they would do so as a result of their own decisions, not as a result of this policy. This policy has no provision that would take private property.

Federalism

In accordance with Executive Order 13132, this policy does not have significant Federalism effects. A Federalism assessment is not required. In keeping with Department of the Interior and Commerce policy, we requested information from and coordinated development of this policy with appropriate resource agencies throughout the United States.

Civil Justice Reform

In accordance with Executive Order 12988, this policy does not unduly burden the judicial system and meets the requirements of sections 3(a) and 3(b)(2) of the Order. With the guidance provided in the policy, requirements under section 4 of the Endangered Species Act will be clarified to entities that voluntarily develop formalized conservation efforts.

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This policy contains collection-of-information requirements subject to the Paperwork Reduction Act (PRA) and which have been approved by Office of Management and Budget (OMB). The FWS has OMB approval for the collection under OMB Control Number 1018–0119, which expires on December 31, 2005. The NMFS has OMB approval for the collection under OMB Control Number 0648–0466, which expires on December 31, 2005. We may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Public reporting burden for FWS collections of information is estimated to average 2,500 hours for developing one agreement with the intent to preclude a listing, 320 hours for annual monitoring under one agreement, and 80 hours for one annual report. The FWS expects that six agreements with the intent of making listing unnecessary will be developed in one year and that four of these will be successful in making listing unnecessary, and therefore, the entities who develop these four agreements will carry through with their monitoring and reporting commitments. Public reporting burden for NMFS collections of information is estimated to average 2,500 hours for developing one agreement with the intent to preclude a listing, 320 hours for annual monitoring under one agreement, and 80 hours for one annual report. The NMFS expects that two agreements with the intent of making listing unnecessary will be developed in one year and that one of these will be successful in making listing unnecessary, and therefore, the entities who develop this agreement will carry through with their monitoring and reporting commitments. These estimates include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate, or any other aspect of this data collection, including suggestions for reducing the burden, to the FWS and NMFS (see **ADDRESSES** section of this policy).

National Environmental Policy Act

We have analyzed this policy in accordance with the criteria of the National Environmental Policy Act (NEPA), the Department of the Interior Manual (318 DM 2.2(g) and 6.3(D)), and National Oceanic and Atmospheric Administration (NOAA) Administrative Order 216–6. This policy does not constitute a major Federal action significantly affecting the quality of the human environment. The FWS has determined that the issuance of the policy is categorically excluded under the Department of the Interior's NEPA procedures in 516 DM 2, Appendix 1 (1.10) and 516 DM 6, Appendix 1. NOAA has determined that the issuance of this policy qualifies for a categorical exclusion as defined by NOAA Administrative Order 216–6, Environmental Review Procedure.

ESA Section 7 Consultation

We have determined that issuance of this policy will not affect species listed as threatened or endangered under the Endangered Species Act, and, therefore, a section 7 consultation on this policy is not required.

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994, ''Government-to-Government Relations with Native American Tribal Governments'' (59 FR 22951), E.O. 13175, and the Department of Interior's 512 DM 2, this policy does not directly affect Tribal resources. The policy may have an indirect effect on Native American Tribes as the policy may influence the type and content of conservation plans and efforts implemented by Tribes, or other entities. The extent of this indirect effect will be determined on a case-by-case basis during our evaluation of individual formalized conservation efforts when we make a listing decision. Under Secretarial Order 3206, we will, at a minimum, share with the entity that developed the formalized conservation effort any information provided by the Tribes, through the public comment period for the listing decision or formal submissions. During the development of conservation plans, we can encourage the incorporation of conservation efforts that will restore or enhance Tribal trust resources. After consultation with the Tribes and the entity that developed the formalized conservation effort and after careful consideration of the Tribe's concerns, we must clearly state the rationale for the recommended final listing decision and explain how the decision relates to our trust responsibility. Accordingly:

(a) We have not yet consulted with the affected Tribe(s). We will address this requirement when we evaluate formalized conservation efforts that have yet to be implemented or have recently been implemented and have yet to show effectiveness at the time we make a listing decision.

(b) We have not yet worked with Tribes on a government-to-government basis. We will address this requirement when we evaluate formalized conservation efforts that have yet to be implemented or have recently been implemented but have yet to show effectiveness at the time we make a listing decision.

(c) We will consider Tribal views in individual evaluations of formalized conservation efforts.

(d) We have not yet consulted with the appropriate bureaus and offices of the Department about the identified effects of this policy on Tribes. This requirement will be addressed with individual evaluations of formalized conservation efforts.

Information Quality

In Accordance with section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106–554), OMB directed Federal agencies to issue and implement guidelines to ensure and maximize the quality, objectivity, utility, and integrity of Government information disseminated to the public (67 FR 8452). Under our Information Quality guidelines, if we use a conservation plan or agreement as part of our decision to either list or not list a species under the Act, the plan or agreement is considered to be disseminated by us and these guidelines apply to the plan or agreement. The criteria outlined in this policy are consistent with OMB, Department of Commerce, NOAA, and Department of the Interior. FWS information quality guidelines. The Department of the Interior's guidelines can be found at *http://www.doi.gov/ocio/guidelines/515Guides.pdf*, and the FWS's guidelines can be found at *http://irm.fws.gov/infoguidelines/.* The Department of Commerce's guidelines can be found at *http://www.osec.doc.gov/cio/oipr/iqg.html*, and the NOAA/NMFS's guidelines can be found at *http://www.noaanews.noaa.gov/stories/iq.htm.* Under these guidelines, any affected person or organization may request from FWS or NMFS, a correction of information they believe to be incorrect in the plan or agreement. ''Affected persons or organizations'' are those who may use, be benefitted by, or be harmed by the disseminated information (i.e., the conservation plan or agreement). The process for submitting a request for correction of information is found in the respective FWS and NOAA guidelines.

Economic Analysis

This policy identifies criteria that a formalized conservation effort must satisfy to ensure certainty of implementation and effectiveness and for us to determine that the conservation effort contributes to making listing a species unnecessary or contributes to forming a basis for listing a species as threatened rather than endangered. We developed this policy to ensure consistent and adequate evaluation of agreements and plans when making listing decisions. The policy will also provide guidance to States and other entities on how we will evaluate certain formalized conservation efforts during the listing process.

The criteria in this policy primarily describe elements that are already included in conservation efforts and that constitute sound conservation planning. For example, the criteria requiring identification of responsible parties, obtaining required authorizations, establishment of objectives, and inclusion of an implementation schedule and monitoring provisions are essential for directing the implementation and affirming the effectiveness of conservation efforts. These kinds of ''planning'' requirements are generally already included in conservation efforts and do not establish any new implementation burdens. Rather, these requirements will help to ensure that conservation efforts are well planned and, therefore, increase the likelihood that conservation efforts will ultimately be successful in making listing species unnecessary.

The development of an agreement or plan by a state or other entity is completely voluntary. However, when a state or other entity voluntarily decides to develop an agreement or plan with the specific intent of making listing a species unnecessary, the criteria identified in this policy can be construed as requirements placed on the development of such agreements or plans. The state or other entity must satisfy these criteria in order to obtain and retain the benefit they are seeking, which is making listing of a species as threatened or endangered unnecessary.

The criteria in the policy require demonstrating certainty of implementation and effectiveness of formalized conservation efforts. We have always considered the certainty of implementation and effectiveness of conservation efforts when making listing decisions. Therefore, we believe that no economic effects on states and other entities will result from using the criteria in this policy as guidance.

Furthermore, publication of this policy will have positive effects by informing States and other entities of the criteria we will use in evaluating formalized conservation efforts when making listing decisions, and thereby guide states and other entities in developing voluntary formalized conservation efforts that will be successful in making listing unnecessary. Therefore, we believe that informational benefits will result from issuing this policy. We believe these benefits, although important, will be insignificant economically.

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Policy for Evaluation of Conservation Efforts When Making Listing Decisions

Policy Purpose

The Fish and Wildlife Service and National Marine Fisheries Service developed this policy to ensure consistent and adequate evaluation of formalized conservation efforts (conservation efforts identified in conservation agreements, conservation plans, management plans, and similar documents) when making listing decisions under the Act. This policy may also guide the development of conservation efforts that sufficiently improve a species' status so as to make listing the species as threatened or endangered unnecessary.

Definitions

''Adaptive management'' is a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.

''Agreements and plans'' include conservation agreements, conservation plans, management plans, or similar documents approved by Federal agencies, State and local governments, Tribal governments, businesses, organizations, or individuals.

''Candidate species,'' as defined by regulations at 50 CFR 424.02(b), means any species being considered for listing as an endangered or a threatened species, but not yet the subject of a proposed rule. However, the FWS includes as candidate species those species for which the FWS has sufficient information on file relative to status and threats to support issuance of proposed listing rules. The NMFS includes as candidate species those species for which it has information indicating that listing may be warranted, but for which sufficient information to support actual proposed listing rules may be lacking. The term ''candidate species'' used in this policy refers to those species designated as candidates by either of the Services.

''Conservation efforts,'' for the purpose of this policy, are specific actions, activities, or programs designed to eliminate or reduce threats or otherwise improve the status of a species. Conservation efforts may involve restoration, enhancement, maintenance, or protection of habitat; reduction of mortality or injury; or other beneficial actions.

''Formalized conservation efforts'' are conservation efforts identified in a conservation agreement, conservation plan, management plan, or similar document. An agreement or plan may contain numerous conservation efforts.

Policy Scope

When making listing decisions, the Services will evaluate whether formalized conservation efforts contribute to making it unnecessary to list a species, or to list a species as threatened rather than endangered. This policy applies to those formalized conservation efforts that have not yet been implemented or have been implemented, but have not yet demonstrated whether they are effective at the time of a listing decision. We will make this evaluation based on the certainty of implementing the conservation effort and the certainty that the effort will be effective. This policy identifies the criteria we will use to help determine the certainty of implementation and effectiveness. Listing decisions covered by the policy include findings on petitions to list species, and decisions on whether to assign candidate status, remove candidate status, issue proposed listing rules, and finalize or withdraw proposed listing rules. This policy applies to formalized conservation efforts developed with or without a specific intent to influence a listing decision and with or without the involvement of the Services.

Section 4(a)(1) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1533(a)(1)), states that we must determine whether a species is threatened or endangered because of any of the following five factors:(A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

Although this language focuses on impacts negatively affecting a species, section 4(b)(1)(A) requires us also to ''tak[e] into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas.'' Read together, sections 4(a)(1) and 4(b)(1)(A), as reflected in our regulations at 50 CFR 424.11(f), require us to take into account any State or local laws, regulations, ordinances, programs, or other specific conservation measures that either positively or negatively affect a species' status (i.e., measures that create, exacerbate, reduce, or remove threats identified through the section 4(a)(1) analysis). The manner in which the section 4(a)(1) factors are framed supports this conclusion. Factor (D) for example—ldquo;the inadequacy of existing regulatory mechanisms''—indicates that overall we might find existing regulatory mechanisms adequate to justify a determination not to list a species.

Factor (E) in section 4(a)(1) (any ''manmade factors affecting [the species'] continued existence'') requires us to consider the pertinent laws, regulations, programs, and other specific actions of any entity that either positively or negatively affect the species. Thus, the analysis outlined in section 4 of the Act requires us to consider the conservation efforts of not only State and foreign governments but also of Federal agencies, Tribal governments, businesses, organizations, or individuals that positively affect the species' status.

While conservation efforts are often informal, such as when a property owner implements conservation measures for a species simply because of concern for the species or interest in protecting its habitat, and without any specific intent to affect a listing decision, conservation efforts are often formalized in conservation agreements, conservation plans, management plans, or similar documents. The development and implementation of such agreements and plans has been an effective mechanism for conserving declining species and has, in some instances, made listing unnecessary. These efforts are consistent with the Act's finding that ''encouraging the States and other interested parties * * * to develop and maintain conservation programs * * * is a key * * * to better safeguarding, for the benefit of all citizens, the Nation's heritage in fish, wildlife, and plants'' (16 U.S.C. 1531 (a)(5)).

In some situations, a listing decision must be made before all formalized conservation efforts have been implemented or before an effort has demonstrated effectiveness. We may determine that a formalized conservation effort that has not yet been implemented has reduced or removed a threat to a species when we have sufficient certainty that the effort will be implemented and will be effective.

Determining whether a species meets the definition of threatened or endangered requires us to analyze a species' risk of extinction. Central to this risk analysis is an assessment of the status of the species (i.e., is it in decline or at risk of decline and at what rate is the decline or risk of decline) and consideration of the likelihood that current or future conditions or actions will promote (see section 4(b)(1)(A)) or threaten a species' persistence. This determination requires us to make a prediction about the future persistence of a species, including consideration of both future negative and positive effects of anticipated human actions. The language of the Act supports this approach. The definitions for both ''endangered species'' and ''threatened species'' connote future condition, which indicates that consideration of whether a species should be listed depends in part on identification and evaluation of future actions that will reduce or remove, as well as create or exacerbate, threats to the species. The first factor in section 4(a)(1)—''the present or *threatened* destruction, modification, or curtailment of [the species'] habitat or range''—identifies how analysis of both current actions affecting a species' habitat or range and those actions that are sufficiently certain to occur in the future and affect a species' habitat or range are necessary to assess a species' status. However, future Federal, State, local, or private actions that affect a species are not limited to actions that will affect a species' habitat or range. Congress did not intend for us to consider future actions affecting a species' habitat or range, yet ignore future actions that will influence overutilization, disease, predation, regulatory mechanisms, or other natural or manmade factors. Therefore, we construe Congress' intent, as reflected by the language of the Act, to require us to consider both current actions that affect a species' status and sufficiently certain future actions—either positive or negative—that affect a species' status. As part of our assessment of future conditions, we will determine whether a formalized conservation effort that has yet to be implemented or has recently been implemented but has yet to show effectiveness provides a high level of certainty that the effort will be implemented and/or effective and results in the elimination or adequate reduction of the threats.

For example, if a state recently designed and approved a program to eliminate collection of a reptile being considered for listing, we must assess how this program affects the status of the species. Since the program was just designed, an implementation and effectiveness record may not yet exist. Therefore, we must evaluate the likelihood, or certainty, that it will be implemented and effective, using evidence such as the State's ability to enforce new regulations, educate the public, monitor compliance, and monitor the effects of the program on the species. Consequently, we would determine that the program reduces the threat of overutilization of the species through collecting if we found sufficient certainty that the program would be implemented and effective.

In another example, a state could have a voluntary incentive program for protection and restoration of riparian habitat that includes providing technical and financial assistance for fencing to exclude livestock. Since the state has already implemented the program, the state does not need to provide certainty that it will be implemented. If the program was only recently implemented and no record of the effects of the program on the species' status existed, we would evaluate the effectiveness of this voluntary program at the time of our listing decision. To assess the effectiveness, we would evaluate the level of participation (e.g., number of participating landowners or number of stream-miles fenced), the length of time of the commitment by landowners, and whether the program reduces the threats on the species. We would determine that the program reduces the threat of habitat loss and degradation if we find sufficient certainty that the program is effective.

In addition, we will consider the estimated length of time that it will take for a formalized conservation effort to produce a positive effect on the species. In some cases, the nature, severity, and/or imminence of threats to a species may be such that a formalized conservation effort cannot be expected to produce results quickly enough to make listing unnecessary since we must determine at the time of the listing decision that the conservation effort has improved the status of the species.

Federal agencies, Tribal governments, state and local governments, businesses, organizations, or individuals contemplating development of an agreement or plan should be aware that, because the Act mandates specific timeframes for making listing decisions, we cannot delay the listing process to allow additional time to complete the development of an agreement or plan. Nevertheless, we encourage the development of agreements and plans even if they will not be completed prior to a final listing decision. Such an agreement or plan could serve as the foundation for a special rule under section 4(d) of the Act, which would establish only those prohibitions necessary and advisable for the conservation of a threatened species, or for a recovery plan, and could lead to earlier recovery and delisting.

This policy provides us guidance for evaluating the certainty of implementation and effectiveness of formalized conservation efforts. This policy is not intended to provide guidance for determining the specific level of conservation (e.g., number of populations or individuals) or the types of conservation efforts (e.g., habitat restoration, local regulatory mechanisms) specifically needed to make listing particular species unnecessary and does not provide guidance for determining when parties should enter into agreements. We do encourage early coordination in conservation measures to prevent the species from meeting the definition of endangered or threatened.

If we make a decision not to list a species or to list the species as threatened rather than endangered based in part on the contributions of a formalized conservation effort, we will track the status of the effort including the progress of implementation and effectiveness of the conservation effort. If any of the following occurs: (1) a failure to implement the conservation effort in accordance with the implementation schedule; (2) a failure to achieve objectives; (3) a failure to modify the conservation effort to adequately address an increase in the severity of a threat or to address other new information on threats; or (4) we receive any other new information indicating a possible change in the status of the species, then we will reevaluate the status of the species and consider whether initiating the listing process is necessary. Initiating the listing process may consist of designating the species as a candidate species and assigning a listing priority, issuing a proposed rule to list, issuing a proposed rule to reclassify, or issuing an emergency listing rule. In some cases, even if the parties fully implement all of the conservation efforts outlined in a particular agreement or plan, we may still need to list the species. For example, this may occur if conservation efforts only cover a portion of a species' range where the species needed to be conserved, or a particular threat to a species was not anticipated or addressed at all, or not adequately addressed, in the agreement or plan.

Evaluation Criteria

Conservation agreements, conservation plans, management plans, and similar documents generally identify numerous conservation efforts (i.e., actions, activities, or programs) to benefit the species. In determining whether a formalized conservation effort contributes to forming a basis for not listing a species, or for listing a species as threatened rather than endangered, we must evaluate whether the conservation effort improves the status of the species under the Act. Two factors are key in that evaluation: (1) for those efforts yet to be implemented, the certainty that the conservation effort will be implemented and (2) for those efforts that have not yet demonstrated effectiveness, the certainty that the conservation effort will be effective. Because the certainty of implementation and effectiveness of formalized conservation efforts may vary, we will evaluate each effort individually and use the following criteria to direct our analysis.

A. The certainty that the conservation effort will be implemented:

1. The conservation effort, the party(ies) to the agreement or plan that will implement the effort, and the staffing, funding level, funding source, and other resources necessary to implement the effort are identified. 2. The legal authority of the party(ies) to the agreement or plan to implement the formalized conservation effort, and the commitment to proceed with the conservation effort are described.3. The legal procedural requirements (e.g. environmental review) necessary to implement the effort are described, and information is provided indicating that fulfillment of these requirements does

not preclude commitment to the effort. 4. Authorizations (e.g., permits, landowner permission) necessary to implement the conservation effort are identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the effort will obtain these authorizations. 5. The type and level of voluntary participation (e.g., number of landowners allowing entry to their land, or number of participants agreeing to change timber management practices and acreage involved) necessary to implement the conservation effort is identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation (e.g., an explanation of how incentives to be provided will result in the necessary level of voluntary participation). 6. Regulatory mechanisms (e.g., laws, regulations, ordinances) necessary to implement the conservation effort are in place. 7. A high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain the necessary funding. 8. An implementation schedule (including incremental completion dates) for the conservation effort is provided. 9. The conservation agreement or plan that includes the conservation effort is approved by all parties to the agreement or plan.

B. The certainty that the conservation effort will be effective:

1. The nature and extent of threats being addressed by the conservation effort are described, and how the conservation effort reduces the threats is described. 2. Explicit incremental objectives for the conservation effort and dates for achieving them are stated. 3. The steps necessary to implement the conservation effort are identified in detail. 4. Quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for these parameters by which progress will be measured, are identified. 5. Provisions for monitoring and reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided.6. Principles of adaptive management are incorporated.

These criteria should not be considered comprehensive evaluation criteria. The certainty of implementation and effectiveness of a formalized conservation effort may also depend on species-specific, habitat-specific, location-specific, and effort-specific factors. We will consider all appropriate factors in evaluating formalized conservation efforts. The specific circumstances will also determine the amount of information necessary to satisfy these criteria.

To consider that a formalized conservation effort(s) contributes to forming a basis for not listing a species or listing a species as threatened rather than endangered, we must find that the conservation effort is sufficiently certain to be implemented and effective so as to have contributed to the elimination or adequate reduction of one or more threats to the species identified through the section 4(a)(1) analysis. The elimination or adequate reduction of section 4(a)(1) threats may lead to a determination that the species does not meet the definition of threatened or endangered, or is threatened rather than endangered. An agreement or plan may contain numerous conservation efforts, not all of which are sufficiently certain to be implemented and effective. Those conservation efforts that are not sufficiently certain to be implemented and effective cannot contribute to a determination that listing is unnecessary or a determination to list as threatened rather than endangered. Regardless of the adoption of a conservation agreement or plan, however, if the best available scientific and commercial data indicate that the species meets the definition of ''endangered species'' or ''threatened species'' on the day of the listing decision, then we must proceed with appropriate rule-making activity under section 4 of the Act.

Dated: September 16, 2002.

Steve Williams,

Director, Fish and Wildlife Service.

December 23, 2002.

William T. Hogarth,

Assistant Administrator for Fisheries, National Marine Fisheries Services.

[FR Doc. 03–7364 Filed 3–27–03; 8:45 am]

BILLING CODES 4310–55–S and 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 679

[Docket No. 021212306–2306–01; I.D. 032403A]

Fisheries of the Exclusive Economic Zone Off Alaska; Pollock in Statistical Area 610 of the Gulf of Alaska

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Modification of a closure.

SUMMARY: NMFS is reopening directed fishing for pollock in Statistical Area 610 of the Gulf of Alaska (GOA) for 24 hours. This action is necessary to fully use the B season allowance of the total allowable catch (TAC) of pollock specified for Statistical Area 610.

DATES: Effective 1200 hrs, Alaska local time (A.l.t.), March 26, 2003, through 1200 hrs, A.l.t., March 27, 2003.

FOR FURTHER INFORMATION CONTACT: Mary Furuness, 907–586–7228.

SUPPLEMENTARY INFORMATION: NMFS manages the groundfish fishery in the GOA exclusive economic zone according to the Fishery Management Plan for Groundfish of the Gulf of Alaska (FMP) prepared by the North Pacific Fishery Management Council under authority of the Magnuson-Stevens Fishery Conservation and Management Act. Regulations governing fishing by U.S. vessels in accordance with the FMP appear at subpart H of 50 CFR part 600 and 50 CFR part 679.

NMFS closed the B season directed fishery for pollock in Statistical Area 610 of the GOA under § 679.20(d)(1)(iii) on March 19, 2003 (68 FR 13857, March 21, 2003).

NMFS has determined that, approximately 986 mt of pollock remain in the B season directed fishing allowance. Therefore, in accordance with 679.25(a)(2)(i)(C) and (a)(2)(iii)(D), and to fully utilize the B season allowance of pollock TAC specified for Statistical Area 610, NMFS is terminating the previous closure and is reopening directed fishing for pollock in Statistical Area 610 of the GOA. In accordance with § 679.20(d)(1)(iii), the Regional Administrator finds that this directed fishing allowance will be reached after 24 hours. Consequently, NMFS is prohibiting directed fishing for pollock in Statistical Area 610 of the GOA effective 1200 hrs, A.l.t., March 27, 2003.

A Report on National Greater Sage-Grouse Conservation Measures

Produced by:

Sage-grouse National Technical Team

December 21, 2011

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Introduction

Sagebrush landscapes have changed dramatically over the last two centuries. The vast expanses of sagebrush crossed by early European settlers and used by sage-grouse have been lost, fragmented, or altered due to invasive plants, changes in fire regimes, and impact of land uses (Knick et al. 2003, Knick and Connelly 2011a). As a consequence, sage-grouse and many other wildlife species that depend on sagebrush have undergone long-term range-wide population declines. Sage-grouse populations now occupy approximately one-half of their pre-European settlement distribution (Schroeder et al. 2004). Anthropogenic habitat impacts and lack of regulatory mechanisms to protect against further losses provided the basis for warranting listing under the Endangered Species Act (ESA) in 2010 (75 FR 13910). The need to address higher priority species and limited funding precluded immediate listing action. However, a litigation settlement requires that a listing decision be made by the U.S. Fish and Wildlife Service (USFWS) by September, 2015.

The Bureau of Land Management (BLM) manages approximately 50% of the sagebrush habitats used by sage-grouse (Knick 2011). Therefore, management actions by BLM in concert with other state and federal agencies, and private land owners play a critical role in the future trends of sage-grouse populations. To ensure BLM management actions are effective and based on the best available science, the National Policy Team created a National Technical Team (NTT) in August of 2011. The BLM's objective for chartering this planning strategy effort was to develop new or revised regulatory mechanisms, through Resource Management Plans (RMPs), to conserve and restore the greater sage-grouse and its habitat on BLM-administered lands on a range-wide basis over the long term. The National Greater Sage-Grouse Planning Strategy Charter charged the NTT to serve as a scientific and technical forum to:

- Understand current scientific knowledge related to the greater sage-grouse.
- Provide specialized sources of expertise not otherwise available.
- Provide innovative scientific perspectives concerning management approaches for the greater sage-grouse.
- Provide assurance that relevant science is considered, reasonably interpreted, and accurately presented; and that uncertainties and risks are acknowledged and documented.
- Provide science and technical assistance to the Regional Management Team (RMT) and Regional Interdisciplinary Team (RIDT), on request.
- Articulate conservation objectives for the greater sage-grouse in measurable terms to guide overall planning.

- Identify science-based management considerations for the greater sage-grouse (e.g., conservation measures) that are necessary to promote sustainable sage-grouse populations, and which focus on the threats (75 FR 13910) in each of the management zones.[i]

The National Technical Team (NTT) met from August 28 through September 2, 2011, in Denver, Colorado, and a subset of the team met December 5-8 in Phoenix, Arizona, to further articulate the scientific basis for the conservation measures. Members of the team included resource specialists and scientists from the BLM, State Fish and Wildlife Agencies, USFWS, Natural Resources Conservation Service (NRCS) and U.S. Geological Survey (USGS).

This document provides the latest science and best biological judgment to assist in making management decisions. Fortunately, recent emphasis on sage-grouse conservation has resulted in a substantial number of publications dealing with a variety of aspects of sage-grouse ecology and management, summarized in the 2010 listing petition (75 FR 13910), as well as Knick and Connelly (2011b). Habitat requirements and other life history aspects of sage-grouse, excerpted from the USFWS listing decision (75 FR 13910), are summarized in Appendix A to provide context for the proposed conservation measures. We have attempted to describe the scientific basis for the conservation measures proposed within each program area. Perspectives on the nature and interpretation of the available science are in Appendix B.

The conservation measures described in this report are not an end point but, rather, a starting point to be used in the BLM's planning processes. Due to time constraints, they are focused primarily on priority sage-grouse habitat areas. General habitat conservation areas were not thoroughly discussed or vetted through the NTT, and the concept of connectivity between priority sage-grouse habitat areas will need more development through the BLM planning process.

[i] Identified in the Western Association of Fish and Wildlife Agencies (WAFWA) Conservation Strategy (Stiver et al. 2006).

Goals and Objectives

The BLM, along with a host of other state and federal agencies who participated in development of the Greater Sage-grouse Comprehensive Conservation Strategy (Stiver et al. 2006), endorsed the goal of that document which was "to maintain and enhance populations and distribution of sage-grouse by protecting and improving sagebrush habitats and ecosystems that sustain these populations". Although it was understood that at least in the short term this goal of maintaining sage-grouse population size and distribution as based on trends from 1965 - 2003, or enhancing above these levels was aspirational, the NTT supports it as a guiding philosophy against which management actions and policies of BLM should be weighed. Therefore, the conservation measures and strategies that follow assume the goal and objectives below.

Goal

Maintain and/or increase sage-grouse abundance and distribution by conserving, enhancing or restoring the sagebrush ecosystem upon which populations depend in cooperation with other conservation partners.

Until such time as more specific conservation objectives relative to sage-grouse distribution or abundance by sage-grouse management zone, state, or population are developed, BLM will strive to maintain or increase current distribution and abundance of sage-grouse on BLM administered lands in support of the range-wide goals. BLM will specifically address threats identified by the Fish and Wildlife Service in their 2010 listing decision (75 FR 13910).

Sage-grouse populations have the greatest chance of persisting when landscapes are dominated by sagebrush and natural or human disturbances are minimal (Aldridge et al. 2008, Knick and Hanser 2011, Wisdom et al. 2011). Within priority habitat, a minimum range of 50-70% of the acreage in sagebrush cover is required for long-term sage-grouse persistence (Aldridge et al. 2008, Doherty et al. 2010, Wisdom et al. 2011). Fire and invasion by exotic grasses are widespread causes for habitat loss, particularly in the western part of the sage-grouse range (Miller et al. 2011). Human land use, including tillage agriculture, historic grazing management, energy development, roads and power line infrastructure, and even recreation have contributed both individually and cumulatively to lower numbers of sage-grouse across the range (75 FR 13910, Knick et al. 2011).

New Paradigm

Through the establishment of the National Sage-grouse Planning Strategy, the Bureau of Land Management has committed to a new paradigm in managing the sagebrush landscape. That new paradigm will require collaborative conservation efforts among private, state, tribal, and other federal partners to conserve sage-grouse. Land uses, habitat treatments, and anthropogenic disturbances will need to be managed below thresholds necessary to conserve not only local sage-grouse populations, but sagebrush communities and landscapes as well. Management priorities will need to be shifted and balanced to maximize benefits to sage-grouse habitats and populations in priority habitats. Adequacy of management adjustments will be measured by science-based effectiveness monitoring of the biological response of sagebrush landscapes and sage-grouse populations. Ultimately, success will be measured by the maintenance and enhancement of sage-grouse populations well into the future.

Objectives

The overall objective is to protect priority sage-grouse habitats from anthropogenic disturbances that will reduce distribution or abundance of sage-grouse. Priority sage-grouse habitats are areas that have the highest conservation value to maintaining or increasing sage-grouse populations. These areas would include breeding, late brood-rearing, winter concentration areas, and where known, migration or connectivity corridors. These areas have been, or will be identified by state fish and wildlife agencies in coordination with respective BLM offices. Priority habitat designations must reflect the vision, goals and objectives of this overall plan if the conservation measures are to be effective. Additionally, there is an opportunity for synergy and collaboration with WAFWA in order to identify a consistent way to designate priority sage-grouse habitat areas and develop a range-wide priority habitat area map. This collaborative and overarching approach could help ensure activities immediately outside the priority areas do not impact priority habitat.

To reach this objective, it will be necessary to achieve the following sub-objectives for priority habitat:

- Designate priority sage-grouse habitats for each WAFWA management zone (Stiver et al. 2006) across the current geographic range of sage-grouse that are large enough to stabilize populations in the short term and enhance populations over the long term.
- To maintain or increase current populations, manage or restore priority areas so that at least 70% of the land cover provides adequate sagebrush habitat to meet sage-grouse needs.
- Develop quantifiable habitat and population objectives with WAFWA and other conservation partners at the management zone and/or other appropriate scales. Develop a monitoring and adaptive management strategy to track whether these objectives are being met, and allow for revisions to management approaches if they are not.[ii]
- Manage priority sage-grouse habitats so that discrete anthropogenic disturbances cover less than 3% of the total sage-grouse habitat regardless of ownership. Anthropogenic features include but are not limited to paved highways, graded gravel roads, transmission lines, substations, wind

[ii] As population trends within each Management Zone respond, long-term success can be judged based on comparisons with data from the 1965-2003 period for that specific Management Zone (Stiver et al., 2006).

[iii] Professional judgment as derived from Holloran 2005, Walker et al. 2007, Doherty et al. 2008, Doherty et al. 2011, Naugle et al. 2011a,b.

turbines, oil and gas wells, geothermal wells and associated facilities, pipelines, landfills, homes, and mines. [iii]

- In priority habitats where the 3% disturbance threshold is already exceeded from any source, no further anthropogenic disturbances will be permitted by BLM until enough habitat has been restored to maintain the area under this threshold (subject to valid existing rights).

- In this instance, an additional objective will be designated for the priority area to prioritize and reclaim/restore anthropogenic disturbances so that 3% or less of the total priority habitat area is disturbed within 10 years.

Note to add context to above objective: Disturbance can be described within categories as discrete (having a distinct measureable impact in space and time) or diffuse (pressure is exerted over broad spatial or temporal scales) (Turner and Gardner 1991). Most anthropogenic disturbance (roads, power lines, oil/gas wells, tall structures) are discrete disturbances. Livestock grazing is a diffuse disturbance. Fire can be either discrete or diffuse depending on its characteristics and the scales at which it is measured. Sage-grouse are extremely sensitive to discrete disturbance (Johnson et al. 2011, Naugle et al. 2011a,b) although diffuse disturbance over broad spatial and temporal scales can have similar, but less visible effects.

Spatial and temporal scales are important components in measuring and interpreting the effects of disturbance (Johnson and St-Laurent 2011). A discrete event might be significant to individuals or local communities but have little effect on the larger population or region (See Figure 2 in Appendix B). Therefore, defining the spatial extent (the region bounding the analysis), spatial and temporal scale (the dimension of the event), and the resolution (the precision of the measurement) are fundamental inputs into any assessment of disturbance (Wheatley and Johnson 2009).

Two spatial extents for measuring anthropogenic disturbance will be used: 1) the area contained within individual priority areas and 2) each one-mile section within the priority area. This hierarchical arrangement allows concentrated anthropogenic disturbance to exceed recommended thresholds within a smaller area, yet still maintain an overall level at the scale to which sage-grouse respond within priority areas.

(1) Large-scale disturbances that impact sage grouse distribution and abundance at any level will not be permitted within priority areas (subject to valid existing rights). Other, smaller scale proposed anthropogenic disturbances will not disturb more than a total of 3% of the acreage within each priority area.

[iii] Professional judgment as derived from Holloran 2005, Walker et al. 2007, Doherty et al. 2008, Doherty et al. 2011, Naugle et al. 2011a,b.

(2) Proposed anthropogenic surface disturbances within an individual priority area will be encouraged to occur in areas of existing development, or areas of non-suitable habitats. Suitable buffers, depending on the occurrence of adjacent seasonal habitats and local information (e.g. migratory vs. non-migratory populations; [Connelly et al. 2000]) may be applied in siting a proposed anthropogenic surface disturbance to protect surrounding suitable, undisturbed habitats.

(3) Concentrating or clustering disturbances locally while maintaining total disturbance below 3% at the priority habitat scale may cause some one-mile^2 analysis sections to exceed the 3% anthropogenic disturbance goal. For example, a sand and gravel mine can result in intensive development of 40 acres, effectively rendering that area unsuitable for sage-grouse. The actual 40-acre disturbance may not push total anthropogenic disturbance to more than 3% for the entire priority area, but obviously has a significant local impact. In these situations, 40 acres of off-site mitigation will be necessary to offset this loss of habitat. The priority is to implement off-site mitigation within the priority sage-grouse habitat, followed by general sage-grouse habitat.

If a project proponent agrees to site proposed anthropogenic surface disturbance within areas of existing development or areas of non-suitable habitat in a priority area, and the resulting localized total surface disturbance exceeds 3% (but the anthropogenic surface disturbance of the entire priority area does not exceed 3%), the need for off-site mitigation should be evaluated on a case-by-case basis.

Additionally, there are sub-objectives that must be met in general sage-grouse habitat. General sage-grouse habitat is occupied (seasonal or year-round) habitat outside of priority habitat. These areas have been, or will be identified by state fish and wildlife agencies in coordination with respective BLM offices.

It will be necessary to achieve the following sub-objectives for general habitat:

- Quantify and delineate general habitat for capability to provide connectivity among priority areas (Knick and Hanser 2011).
- Conserve, enhance or restore sage-grouse habitat and connectivity (Knick and Hanser 2011) to promote movement and genetic diversity, with emphasis on those habitats occupied by sage-grouse.
- Assess general sage-grouse habitats to determine potential to replace lost priority habitat caused by perturbations and/or disturbances and provide connectivity (Knick and Hanser 2011) between priority areas.
    - o These habitats should be given some priority over other general sage-grouse habitats that provide marginal or substandard sage-grouse habitat.

- Restore historical habitat functionality to support sage-grouse populations guided by objectives to maintain or enhance connectivity. Total area and locations will be determined at the Land Use Plan level.

- Enhance general sage-grouse habitat such that population declines in one area are replaced elsewhere within the habitat.

Conservation Measures

The following conservation measures are designed to achieve population and habitat objectives stated in this report. They are organized by resource programs.

Travel and Transportation

The Travel and Transportation program is principally focused on road networks within the sage-grouse range. Roads can range from state or interstate highways to gravel and two-track roads. Within the sage-grouse range, 95% of the mapped sagebrush habitats are within 2.5 km (1.55 miles) of a mapped road; density of secondary roads exceeds 5 km/km^2 (3.1 miles/247 acres) in some regions (Knick et al. 2011).

Roads have multiple impacts on wildlife in terrestrial ecosystems, including:

1) Increased mortality from collision with vehicles;
2) Changes in behavior;
3) Loss, fragmentation, and alteration of habitat;
4) Spread of exotic species; and
5) Increased human access, resulting in facilitation of additional alteration and use of habitats by humans (Formann and Alexander 1998, Jackson 2000, Trombulak and Frissel 2000).

The effect of roads can be expressed directly through changes in habitat and sage-grouse populations and indirectly through avoidance behavior because of noise created by vehicle traffic (Lyon and Anderson 2003, 75 FR 13910).

<u>Priority sage-grouse habitat areas</u>

- Limit motorized travel to designated roads, primitive roads, and trails at a minimum.
- Travel management should evaluate the need for permanent or seasonal road or area closures.
- Complete activity level plans within five years of the record of decision. During activity level planning, where appropriate, designate routes with current administrative/agency purpose or need to administrative access only.
- Limit route construction to realignments of existing designated routes if that realignment has a minimal impact on sage-grouse habitat, eliminates the need to construct a new road, or is necessary for motorist safety
- Use existing roads, or realignments as described above to access valid existing rights that are not yet developed. If valid existing rights cannot be accessed via existing roads, then build any new road constructed to the absolute minimum standard necessary, and add the surface disturbance to the total disturbance in the priority area. If that disturbance exceeds 3 % for that area, then make additional, effective mitigation necessary to offset the resulting loss of sage-grouse habitat (see Objectives).

- Allow no upgrading of existing routes that would change route category (road, primitive road, or trail) or capacity unless the upgrading would have minimal impact on sage-grouse habitat, is necessary for motorist safety, or eliminates the need to construct a new road.
- Conduct restoration of roads, primitive roads and trails not designated in travel management plans. This also includes primitive route/roads that were not designated in Wilderness Study Areas and within lands with wilderness characteristics that have been selected for protection.
- When reseeding roads, primitive roads and trails, use appropriate seed mixes and consider the use of transplanted sagebrush.

Recreation

Recreational activities in sagebrush habitats range from hiking, camping and hunting to lek viewing, and off-highway vehicle (OHV) use. Many of these activities are benign uses in sagebrush habitats. However, excessive use, such as repeated disturbance to leks for viewing that disrupts sage-grouse breeding activities, can have negative effects (75 FR 13910). Off-trail recreation by OHV users can fragment habitat and create corridors for spread of exotic plant species (Knick et al. 2011).

Special Recreation Permits (SRP)

- Only allow SRPs that have neutral or beneficial affects to priority habitat areas.

Lands/Realty

The Lands and Realty program primarily influences rights-of-way (ROWs), land tenure adjustments, and proposed land withdrawals. Existing and proposed developments for ROWs (such as powerlines, pipelines, and renewable energy projects) and access to various mineral claims or energy development locations have the potential to cause habitat loss and fragmentation that decreases habitat and population connectivity. Roads also create corridors that facilitate spread of exotic plant species (Gelbard and Belnap 2003). In addition, roads and infrastructure networks can increase sage-grouse mortality from increased predation and collisions with vehicles. Sage-grouse may avoid areas because of noise from vehicle traffic (Lyon and Anderson 2003). Adjustments for land tenure and strategically-located land withdrawals can be used to increase connectivity within sage-grouse populations and sagebrush habitats (Knick and Hanser 2011). In addition, land acquisitions and withdrawals may be important conservation strategies because increased development on private lands, which is not subject to mitigation, will focus greater needs for conservation of sage-grouse and sagebrush on public lands (Knick et al. 2011).

Rights of Way

Priority sage-grouse habitat areas

- Make priority sage-grouse habitat areas exclusion areas for new ROWs permits. Consider the following exceptions:

- o Within designated ROW corridors encumbered by existing ROW authorizations: new ROWs may be co-located only if the entire footprint of the proposed project (including construction and staging), can be completed within the existing disturbance associated with the authorized ROWs.
- o Subject to valid, existing rights: where new ROWs associated with valid existing rights are required, co-locate new ROWs within existing ROWs or where it best minimizes sage-grouse impacts. Use existing roads, or realignments as described above, to access valid existing rights that are not yet developed. If valid existing rights cannot be accessed via existing roads, then build any new road constructed to the absolute minimum standard necessary, and add the surface disturbance to the total disturbance in the priority area. If that disturbance exceeds 3% for that area, then make additional effective mitigation necessary to offset the resulting loss of sage-grouse.

- Evaluate and take advantage of opportunities to remove, bury, or modify existing power lines within priority sage-grouse habitat areas. Sage-grouse may avoid powerlines because of increased predation risk (Steenhof et al. 1993, Lammers and Collopy 2007). Powerlines effectively influence (direct physical area plus estimated area of effect due to predator movements) at least 39% of the sage-grouse range (Knick et al. 2011). Deaths resulting from collisions with powerlines were an important source of mortality for sage-grouse in southeastern Idaho (Beck et al. 2006, 75 FR 13910)
- Where existing leases or ROWs have had some level of development (road, fence, well, etc.) and are no longer in use, reclaim the site by removing these features and restoring the habitat.

Planning Direction Note: While engaged in this sage-grouse EIS planning process, relocate existing designated ROW corridors crossing priority sage-grouse habitat void of any authorized ROWs, outside of the priority habitat area. If relocation is not possible, undesignate that entire corridor during the planning process.

General sage-grouse habitat areas

- Make general sage-grouse habitat areas "avoidance areas" for new ROWs.
- Where new ROWs are necessary, co-locate new ROWs within existing ROWs where possible.

Land Tenure Adjustment

Priority sage-grouse habitat areas

- Retain public ownership of priority sage-grouse habitat. Consider exceptions where:
  - o There is mixed ownership, and land exchanges would allow for additional or more contiguous federal ownership patterns within the priority sage-grouse habitat area.
  - o Under priority sage-grouse habitat areas with minority federal ownership, include an additional, effective mitigation agreement for any disposal of federal land. As a final preservation measure consideration should be given to pursuing a permanent conservation easement.

- Where suitable conservation actions cannot be achieved, seek to acquire state and private lands with intact subsurface mineral estate by donation, purchase or exchange in order to best conserve, enhance or restore sage-grouse habitat.

Proposed Land Withdrawals

Priority sage-grouse habitat areas

- Propose lands within priority sage-grouse habitat areas for mineral withdrawal.
- Do not approve withdrawal proposals not associated with mineral activity unless the land management is consistent with sage-grouse conservation measures. (For example; in a proposed withdrawal for a military training range buffer area, manage the buffer area with sage-grouse conservation measures.)

Range Management

Potential impacts of herbivory on sage-grouse and their habitat include:

1) Long-term effects of historic overgrazing on sagebrush habitat;

2) Sage-grouse habitat changes due to herbivory;

3) Direct effects of herbivores on sage-grouse, such as trampling of nests and eggs;

4) Altered sage-grouse behavior due to presence of herbivores; and

5) Impacts to sage-grouse and sage-grouse behavior from structures associated with grazing management (Beck and Mitchell 2000).

Managing livestock grazing to maintain residual cover of herbaceous vegetation so as to reduce predation during nesting may be the most beneficial for sage-grouse populations (Beck and Mitchell 2000, Aldridge and Brigham 2003). Other management objectives that control livestock movements and grazing intensities can be achieved broadly through rotational grazing patterns or locally through water and salt placements (Beck and Mitchell 2000). Treatments used to manipulate vegetation ultimately may have far greater effect on sage-grouse through long-term habitat changes rather than direct impacts of grazing itself (Freilich et al. 2003, Knick et al. 2011). An important objective in managing livestock grazing is to maintain residual cover of herbaceous vegetation to reduce predation during nesting (Beck and Mitchell 2000) and to maintain the integrity of riparian vegetation and other wetlands (Crawford et al. 2004). Proper livestock management (timing, location, and intensity) can assist in meeting sage-grouse habitat objectives and reduce fuels (Briske et al. 2011).

- Within priority sage-grouse habitat, incorporate sage-grouse habitat objectives and management considerations into all BLM grazing allotments through AMPs or permit renewals.

- Work cooperatively on integrated ranch planning within sage-grouse habitat so operations with deeded/BLM allotments can be planned as single units.
- Prioritize completion of land health assessments and processing grazing permits within priority sage-grouse habitat areas. Focus this process on allotments that have the best opportunities for conserving, enhancing or restoring habitat for sage-grouse. Utilize Ecological Site Descriptions (ESDs) to conduct land health assessments to determine if standards of range-land health are being met.
- Conduct land health assessments that include (at a minimum) indicators and measurements of structure/condition/composition of vegetation specific to achieving sage-grouse habitat objectives (Doherty et al. 2011). If local/state seasonal habitat objectives are not available, use sage-grouse habitat recommendations from Connelly et al. 2000b and Hagen et al. 2007.

Implementing Management Actions after Land Health and Habitat Evaluations

- Develop specific objectives to conserve, enhance or restore priority sage-grouse habitat based on ESDs and assessments (including within wetlands and riparian areas). If an effective grazing system that meets sage-grouse habitat requirements is not already in place, analyze at least one alternative that conserves, restores or enhances sage-grouse habitat in the NEPA document prepared for the permit renewal (Doherty et al. 2011b, Williams et al. 2011).
- Manage for vegetation composition and structure consistent with ecological site potential and within the reference state to achieve sage-grouse seasonal habitat objectives.
- Implement management actions (grazing decisions, AMP/Conservation Plan development, or other agreements) to modify grazing management to meet seasonal sage-grouse habitat requirements (Connelly et al. 2011c). Consider singly, or in combination, changes in:

    1) Season or timing of use;

    2) Numbers of livestock (includes temporary non-use or livestock removal);

    3) Distribution of livestock use;

    4) Intensity of use; and

    5) Type of livestock (e.g., cattle, sheep, horses, llamas, alpacas and goats) (Briske et al. 2011).

- During drought periods, prioritize evaluating effects of the drought in priority sage-grouse habitat areas relative to their needs for food and cover. Since there is a lag in vegetation recovery following drought (Thurow and Taylor 1999, Cagney et al. 2010), ensure that post-drought management allows for vegetation recovery that meets sage-grouse needs in priority sage-grouse habitat areas.

Riparian Areas and Wet Meadows

- Manage riparian areas and wet meadows for proper functioning condition within priority sage-grouse habitats.
    - Within priority and general sage-grouse habitats, manage wet meadows to maintain a component of perennial forbs with diverse species richness relative to site potential (e.g., reference state) to facilitate brood rearing. Also conserve or enhance these wet meadow complexes to maintain or increase amount of edge and cover within that edge to minimize elevated mortality during the late brood rearing period (Hagen et al. 2007, Kolada et al. 2009, Atamian et al. 2010).
- Where riparian areas and wet meadows meet proper functioning condition, strive to attain reference state vegetation relative to the ecological site description.
    - For example: Within priority sage-grouse habitat, reduce hot season grazing on riparian and meadow complexes to promote recovery or maintenance of appropriate vegetation and water quality. Utilize fencing/herding techniques or seasonal use or livestock distribution changes to reduce pressure on riparian or wet meadow vegetation used by sage-grouse in the hot season (summer) (Aldridge and Brigham 2002, Crawford et al. 2004, Hagen et al. 2007).
- Authorize new water development for diversion from spring or seep source only when priority sage-grouse habitat would benefit from the development. This includes developing new water sources for livestock as part of an AMP/conservation plan to improve sage-grouse habitat.
- Analyze springs, seeps and associated pipelines to determine if modifications are necessary to maintain the continuity of the predevelopment riparian area within priority sage-grouse habitats. Make modifications where necessary, considering impacts to other water uses when such considerations are neutral or beneficial to sage-grouse.

Treatments to Increase Forage for Livestock/Wild Ungulates

Priority sage-grouse habitat areas

- Only allow treatments that conserve, enhance or restore sage-grouse habitat (this includes treatments that benefit livestock as part of an AMP/Conservation Plan to improve sage-grouse habitat.[iv]
- Evaluate the role of existing seedings that are currently composed of primarily introduced perennial grasses in and adjacent to priority sage-grouse habitats to determine if they should be restored to sagebrush or habitat of higher quality for sage-grouse. If these seedings are part of an AMP/

[iv] Conserve or enhance means to allow no degradation and can mean that the improvement or livestock supplement is part of a grazing/AMP/Conservation Plan that facilitates meeting sage-grouse habitat objectives within a pasture or allotment.

Conservation Plan or if they provide value in conserving or enhancing the rest of the priority habitats, then no restoration would be necessary. Assess the compatibility of these seedings for sage-grouse habitat or as a component of a grazing system during the land health assessments (Davies et al. 2011).

  - For example: Some introduced grass seedings are an integral part of a livestock management plan and reduce grazing pressure in important sagebrush habitats or serve as a strategic fuels management area.

Structural Range Improvements and Livestock Management Tools

<u>Priority sage-grouse habitat areas</u>

- Design any new structural range improvements and location of supplements (salt or protein blocks) to conserve, enhance, or restore sage-grouse habitat through an improved grazing management system relative to sage-grouse objectives. Structural range improvements, in this context, include but are not limited to: cattleguards, fences, exclosures, corrals or other livestock handling structures; pipelines, troughs, storage tanks (including moveable tanks used in livestock water hauling), windmills, ponds/reservoirs, solar panels and spring developments. Potential for invasive species establishment or increase following construction must be considered in the project planning process and monitored and treated post-construction.
- When developing or modifying water developments, use best management practices (BMPs, see Appendix C) to mitigate potential impacts from West Nile virus (Clark et al. 2006, Doherty 2007, Walker et al. 2007b, Walker and Naugle 2011).
- Evaluate existing structural range improvements and location of supplements (salt or protein blocks) to make sure they conserve, enhance or restore sage-grouse habitat.
  - To reduce outright sage-grouse strikes and mortality, remove, modify or mark fences in high risk areas within priority sage-grouse habitat based on proximity to lek, lek size, and topography (Christiansen 2009, Stevens 2011).
  - Monitor for, and treat invasive species associated with existing range improvements (Gelbard and Belnap 2003 and Bergquist et al. 2007).

Retirement of Grazing Privileges

- Maintain retirement of grazing privileges as an option in priority sage-grouse areas when base property is transferred or the current permittee is willing to retire grazing on all or part of an allotment. Analyze the adverse impacts of no livestock use on wildfire and invasive species threats (Crawford et al. 2004) in evaluating retirement proposals.

    Planning direction Note: Each planning effort will identify the specific allotment(s) where permanent retirement of grazing privileges is potentially beneficial.

Wild Horse and Burro Management

Wild horses and burros have the potential to impact habitats used by sage-grouse by reducing grass, shrub, and forb cover and increasing unpalatable forbs and exotic plants including cheatgrass (Beever and Aldridge 2011). Effects of wild equids on habitats may be especially pronounced during periods of drought or vegetation stress. Wild equids have different grazing patterns than domestic livestock, thus increasing the magnitude of grazing across the entire landscape (Beever and Aldridge 2011).

Ongoing Authorizations/Activities

- Manage wild horse and burro population levels within established Appropriate Management Levels (AML).
- Prioritize gathers in priority sage-grouse habitat, unless removals are necessary in other areas to prevent catastrophic environmental issues, including herd health impacts.

Proposed Authorization/Activities

- Within priority sage-grouse habitat, develop or amend herd management area plans (HMAPs) to incorporate sage-grouse habitat objectives and management considerations for all BLM herd management areas (HMAs).
    - For all HMAs within priority sage-grouse habitat, prioritize the evaluation of all AMLs based on indicators that address structure/condition/composition of vegetation and measurements specific to achieving sage-grouse habitat objectives.
- Coordinate with other resources (Range, Wildlife, and Riparian) to conduct land health assessments to determine existing structure/condition/composition of vegetation within all BLM HMAs.
- When conducting NEPA analysis for wild horse and burro management activities, water developments or other rangeland improvements for wild horses in priority sage-grouse habitat, address the direct and indirect effects to sage-grouse populations and habitat. Implement any water developments or rangeland improvements using the criteria identified for domestic livestock identified above in priority habitats.

Minerals

The primary potential risks to sage-grouse from energy and mineral development are:

1) Direct disturbance, displacement, or mortality of grouse;
2) Direct loss of habitat, or loss of effective habitat through fragmentation and reduced habitat patch size and quality; and
3) Cumulative landscape-level impacts (Bergquist et al. 2007, Walston et al. 2009, Naugle et al. 2011).

There is strong evidence from the literature to support that surface-disturbing energy or mineral development within priority sage-grouse habitats is not consistent with a goal to maintain or increase populations or distribution. None of the published science reports a positive influence of development on sage-grouse populations or habitats. Breeding populations are severely reduced at well pad densities commonly permitted (Holloran 2005, Walker et al. 2007a). Magnitude of losses varies from one field to another, but findings suggest that impacts are universally negative and typically severe.

Mechanisms that lead to avoidance and decreased fitness have not been empirically tested but rather suggested from multiple correlative and observational studies. For example, abandonment may increase if leks are repeatedly disturbed by raptors perching on power lines near leks (Ellis 1984), by vehicle traffic on nearby roads (Lyon and Anderson 2003), or by noise and human activity associated with energy development during the breeding season (Remington and Braun 1991, Holloran 2005, Kaiser 2006, Blickley and Patricelli *In review*). One recently completed research study in Wyoming (Blickley et al. *In press*), experimentally validates noise from natural gas drilling and roads resulted in a decline of 29% and 73% respectively in male peak attendance at leks relative to paired controls; declines were immediate and sustained throughout the experiment with low statistical support for a cumulative effect of noise over time. Collisions with nearby power lines and vehicles and increased predation by raptors may also increase mortality of birds at leks (Connelly et al. 2000). Alternatively, roads and power lines may indirectly affect lek persistence by altering productivity of local populations or survival at other times of the year. For example, sage-grouse mortality associated with power lines and roads occurs year-round (Beck et al. 2006, Aldridge and Boyce 2007), and ponds created by coal bed natural gas development may increase the risk of West Nile virus mortality in late summer (Walker et al. 2004, Zou et al. 2006, Walker et al. 2007b). Loss and degradation of sagebrush habitat can also reduce carrying capacity of local breeding populations (Swenson et al. 1987, Braun 1998, Connelly et al. 2000, 2000b, Crawford et al. 2004). Birds may avoid otherwise suitable habitat as the density of roads, power lines, or energy development increases (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Doherty et al. 2008, Carpenter et al. 2010).

Negative responses of sage-grouse to energy development were consistent among studies regardless of whether they examined lek dynamics or demographic rates of specific cohorts within populations. Sage-grouse populations decline when birds avoid infrastructure in one or more seasons (Doherty et al. 2008, Carpenter et al. 2010) and when cumulative impacts of development negatively affect reproduction or survival (Aldridge and Boyce 2007), or both demographic rates (Lyon and Anderson 2003, Holloran 2005, Holloran et al. 2010). Avoidance of energy development at the scale of entire oil and gas fields should not be considered a simple shift in habitat use but rather a reduction in the distribution of sage-grouse (Walker et al. 2007). Avoidance is likely to result in true population declines if density dependence, competition, or displacement of birds into poorer-quality adjacent habitats lowers survival or reproduction (Holloran and Anderson 2005, Aldridge and Boyce 2007, Holloran et al. 2010). High site fidelity in sage-grouse also suggests that unfamiliarity with new habitats may also reduce survival, as in other grouse species (Yoder et al. 2004). Sage-grouse in the Powder River Basin were 1.3 times more likely to occupy winter habitats that had not been developed for energy (12 wells per 4 square kilometers or 12 wells per 1.5 square miles), and avoidance of developed areas was most pronounced when it occurred in high-quality winter habitat with abundant sagebrush (Doherty et al. 2008). In a similar study in Alberta, avoidance of otherwise suitable wintering habitats within a 1.9-kilometer (1.2 mile) radius of energy development resulted in substantial loss of functional habitat surrounding wells (Carpenter et al. 2010).

Long-term studies in the Pinedale Anticline Project Area in southwest Wyoming present the most complete picture of cumulative impacts and provide a mechanistic explanation for declines in populations. Early in development, nest sites were farther from disturbed than undisturbed leks, the rate of nest initiation from disturbed leks was 24 percent lower than for birds breeding on undisturbed leks, and 26 percent fewer females from disturbed leks initiated nests in consecutive years (Lyon and Anderson 2003). As development progressed, adult females remained in traditional nesting areas regardless of increasing levels of development, but yearlings that had not yet imprinted on habitats inside the gas field avoided development by nesting farther from roads (Holloran 2005). The most recent study confirmed that yearling females avoided infrastructure when selecting nest sites, and yearling males avoided leks inside of development and were displaced to the periphery of the gas field (Holloran et al. 2010). Recruitment of males to leks also declined as distance within the external limit of development increased, indicating a high likelihood of lek loss near the center of developed oil and gas fields (Kaiser 2006). The most important finding from studies in Pinedale was that sage-grouse declines are explained in part by lower annual survival of female sage-grouse and that the impact on survival resulted in a population-level decline (Holloran 2005). High site fidelity but low survival of adult sage-grouse combined with lek avoidance by younger birds (Holloran et al. 2010) resulted in a time lag of 3–4 years between the onset of development activities and lek loss (Holloran 2005). The time lag observed by Holloran (2005) in the Anticline matched that for leks that became inactive 3–4 years after natural gas development in the Powder River Basin (Walker et al. 2007a). Analysis of seven oil and gas fields across Wyoming showed time lags of 2–10 years between activities associated with energy development and its measurable effects on sage-grouse populations (Harju et al. 2010).

Impacts as measured by the number of males attending leks are most severe near the lek, remain discernible out to >4 miles (Holloran 2005, Walker et al. 2007, Tack 2009, Johnson et al. 2011), and often result in lek extirpations (Holloran 2005, Walker et al. 2007). Negative effects of well surface occupancy were apparent out to 3.1 miles, the largest radius investigated, in 2 of 7 study areas in Wyoming (Harju et al. 2010). Curvilinear relationships show that lek counts decreased with distance to the nearest active drilling rig, producing well, or main haul road and that development within 3 to 4 miles of leks decrease counts of displaying males (Holloran 2005). All well-supported models in Walker et al. (2007) indicate a strong negative effect, estimated as proportion of development within either 0.5 miles or 2 miles, on lek persistence. A model with development at 4 miles had less support, but the regression coefficient indicated that negative impacts within 4 miles were still apparent. Two additional studies reported negative impacts apparent out to 8 miles on large lek occurrence (>25 males; Tack 2009) and out to 11.7 miles on lek trends (Johnson et al. 2011), the largest scales evaluated.

Past BLM conservation measures have focused on 0.25 mile No Surface Occupancy (NSO) buffers around leks, and timing stipulations applied to 0.6 mile buffers around leks to protect both breeding and nesting activities. Given impacts of large scale disturbances described above that occur across seasons and impact all demographic rates, applying NSO or other buffers around leks at any distance is unlikely to be effective. Even if this approach were to be continued, it should be noted that protecting even 75 to >80% of nesting hens would require a 4-mile radius buffer (Table 1). Even a 4-mile NSO buffer would not be large enough to offset all the impacts reviewed above. A 4-mile NSO likely would not be practical given most leases are not large enough to accommodate a buffer of this size, and lek spacing within priority habitats is such that lek-based buffers may overlap and preclude all development.

We do not include timing restrictions on construction and drilling during the breeding season because they do not prevent impacts of infrastructure (e.g., avoidance, mortality) at other times of the year, during the production phase, or in other seasonal habitats that are crucial for population persistence (e.g., winter; Walker et al. 2007). Seasonal timing restrictions may be effective during the exploration phase. Instead, we recommend excluding mineral development and other large scale disturbances from priority habitats where possible, and where it is not limit disturbance as much as possible.

For these reasons, we believe the conservation strategy most likely to meet the objective of maintaining or increasing sage-grouse distribution and abundance is to exclude energy development and other large scale disturbances from priority habitats, and where valid existing rights exist, minimize those impacts by keeping disturbances to 1 per section with direct surface disturbance impacts held to 3% of the area or less.

Table 1. Distance Of Greater Sage-Grouse Nests From Lek Of Capture[1]

% Nests within 2-mi. radius	% Nests Within 4-mi. radius	Location	Study
46.4 (n = 13/28)	85.7 (n = 24/28)	North Park, CO	Peterson (1980)
59.5 (n = 182/306)	85 (n = 260/306)	Idaho	Autenrieth (1981)
71.8 (n = 51/71)	90.1 (n = 64/71)	North Park, CO	Giesen (1995)
49.5 (n = 192/388)	77.1 (n = 299/388)	Moffat County, CO	Thompson et al. 2005, Thompson 2006
48.4 (n = 15/31)	96.8 (n = 30/31)	Eagle and South Routt Counties, CO	Graham and McConnell 2004, Graham and Jones 2005
44.7 (n = 152/340)	74.4 (n = 243/340)	Wyoming	Holloran and Anderson (2005)
35.5 (n = 86/238)	61 (n = 145/238) @ 3 miles (data unavailable at this time for 4 miles)	Montana	Moynahan and Lindberg (2006)
35.5 (n = 27/76)	76.3 (n = 58/76)	Montana	Tack (2009)
50 (n = 495)	>80 (n = 495)	Oregon	Hagen (2011)

[1]Data obtained from Colorado Greater Sage-grouse Conservation Plan and additional recent studies/plans.

Fluid Minerals

Unleased Federal Fluid Mineral Estate

Alternative A

- Close priority sage-grouse habitat areas to fluid mineral leasing. Upon expiration or termination of existing leases, do not accept nominations/expressions of interest for parcels within priority areas.
- Allow geophysical exploration within priority sage-grouse habitat areas to obtain exploratory information for areas outside of and adjacent to priority sage-grouse habitat areas. Allow geophysical operations only by helicopter-portable drilling methods and in accordance with seasonal timing restrictions and/or other restrictions that may apply.

Alternative B

- Close priority sage-grouse habitat areas to fluid mineral leasing. Consider an exception:
  - When there is an opportunity for the BLM to influence conservation measures where surface and/or mineral ownership is not entirely federally owned (i.e., checkerboard ownership). In this case, a plan amendment may be developed that opens the priority area for new leasing. The plan must demonstrate long-term population increases in the priority area through mitigation (prior to issuing the lease) including lease stipulations, off-site mitigation, etc., and avoid short-term losses that put the sage-grouse population at risk from stochastic events leading to extirpation.
- Allow geophysical exploration within priority sage-grouse habitat areas to obtain exploratory information for areas outside of and adjacent to priority sage-grouse habitat areas. Only allow geophysical operations by helicopter-portable drilling methods and in accordance with seasonal timing restrictions and/or other restrictions that may apply.

Leased Federal Fluid Mineral Estate

Priority sage-grouse habitat areas (with varying levels of exploration & development)

Apply the following conservation measures through Resource Management Plan (RMP) implementation decisions (e.g., approval of an Application for Permit to Drill, Sundry Notice, etc.) and upon completion of the environmental record of review (43 CFR 3162.5), including appropriate documentation of compliance with NEPA. In this process evaluate, among other things:

1. Whether the conservation measure is "reasonable" (43 CFR 3101.1-2) with the valid existing rights; and
2. Whether the action is in conformance with the approved RMP.[v]

[v] Plan conformance means, "a resource management action shall be specifically provided for in the plan, or if not specifically mentioned, shall be clearly consistent with the terms, conditions, and decisions of the approved plan or amendment." 43 CFR 1601.0-5(b).

Provide the following conservation measures as terms and conditions of the approved RMP:

- Do not allow new surface occupancy on federal leases within priority habitats, this includes winter concentration areas (Doherty et al. 2008, Carpenter et al. 2010) during any time of the year. Consider an exception:
    - If the lease is entirely within priority habitats, apply a 4-mile NSO around the lek, and limit permitted disturbances to 1 per section with no more than 3% surface disturbance in that section.
    - If the entire lease is within the 4-mile lek perimeter, limit permitted disturbances to 1 per section with no more than 3% surface disturbance in that section. Require any development to be placed at the most distal part of the lease from the lek, or, depending on topography and other habitat aspects, in an area that is less demonstrably harmful to sage-grouse.
- Apply a seasonal restriction on exploratory drilling that prohibits surface-disturbing activities during the nesting and early brood-rearing season in all priority sage-grouse habitat during this period.
- Do not use Categorical Exclusions (CXs) including under the Energy Policy Act of 2005, Section 390 in priority sage-grouse habitats due to resource conflicts.
- Complete Master Development Plans in lieu of Application for Permit to Drill (APD)-by-APD processing for all but wildcat wells.
- When permitting APDs on existing leases that are not yet developed, the proposed surface disturbance cannot exceed 3% for that area. Consider an exception if:
    - Additional, effective mitigation is demonstrated to offset the resulting loss of sage-grouse (see Objectives).
        - When necessary, conduct additional, effective mitigation in 1) priority sage-grouse habitat areas or – less preferably – 2) general sage-grouse habitat (dependent upon the area-specific ability to increase sage-grouse populations).
        - Conduct additional, effective mitigation first within the same population area where the impact is realized, and if not possible then conduct mitigation within the same Management Zone as the impact, per 2006 WAFWA Strategy – pg 2-17.
- Require unitization when deemed necessary for proper development and operation of an area (with strong oversight and monitoring) to minimize adverse impacts to sage-grouse according to the Federal Lease Form, 3100-11, Sections 4 and 6.
- Identify areas where acquisitions (including subsurface mineral rights) or conservation easements, would benefit sage-grouse habitat.
- Require a full reclamation bond specific to the site. Insure bonds are sufficient for costs relative to reclamation (Connelly et al. 2000, Hagen et al. 2007) that would result in full restoration. Base the reclamation costs on the assumption that contractors for the BLM will perform the work.

- Make applicable Best Management Practices (BMPs, see Appendix D) mandatory as Conditions of Approval within priority sage-grouse habitat.

Solid Minerals

Coal

Priority sage-grouse habitat areas

- *Surface mines*: Find unsuitable all surface mining of coal under the criteria set forth in 43 CFR 3461.5.
- *Sub-surface mines:* Grant no new mining leases unless all surface disturbances (appurtenant facilities) are placed outside of the priority sage-grouse habitat area.
- For coal mining operations on existing leases:
    - *Sub-surface mining:* in priority sage-grouse habitat areas, place any new appurtenant facilities outside of priority areas. Where new appurtenant facilities associated with the existing lease cannot be located outside the priority sage-grouse habitat area, co-locate new facilities within existing disturbed areas. If this is not possible, then build any new appurtenant facilities to the absolute minimum standard necessary.

General sage-grouse habitat

- Apply minimization of surface-disturbing or disrupting activities (including operations and maintenance) where needed to reduce the impacts of human activities on important seasonal sage-grouse habitats. Apply these measures during activity level planning.
    - Use additional, effective mitigation to offset impacts as appropriate (determined by local options/needs).

Locatable Minerals

Priority sage-grouse habitat areas

- Propose withdrawal from mineral entry based on risk to the sage-grouse and its habitat from conflicting locatable mineral potential and development.
    - Make any existing claims within the withdrawal area subject to validity patent exams or buy out. Include claims that have been subsequently determined to be null and void in the proposed withdrawal.
    - In plans of operations required prior to any proposed surface disturbing activities, include the following:
        - Additional, effective mitigation in perpetuity for conservation (In accordance with existing policy, WO IM 2008-204). Example: purchase private land and mineral rights or severed subsurface mineral rights within the priority area and deed to US Government).

    - Consider seasonal restrictions if deemed effective.
  - Make applicable Best Management Practices (see Appendix E) mandatory as Conditions of Approval within priority sage-grouse habitat.

Non-energy Leasable Minerals (i.e. sodium, potash)

Priority sage-grouse habitat areas

- Close priority habitat to non-energy leasable mineral leasing. This includes not permitting any new leases to expand an existing mine.
- For existing non-energy leasable mineral leases, in addition to the solid minerals BMPs (Appendix E), follow the same BMPs applied to Fluid Minerals (Appendix D), when wells are used for solution mining.

Saleable Mineral Materials

Priority sage-grouse habitat areas

- Close priority habitat to mineral material sales.
- Restore saleable mineral pits no longer in use to meet sage-grouse habitat conservation objectives.

Mineral Split Estate

Priority sage-grouse habitat areas

- Where the federal government owns the mineral estate, and the surface is in non-federal ownership, apply the conservation measures applied on public lands.
- Where the federal government owns the surface, and the mineral estate is in non-federal ownership, apply appropriate Fluid Mineral BMPs (see Appendix D) to surface development.

Wildfire Suppression, Fuels Management and Fire Rehabilitation

These programs address the threats resulting from wildfires and post-wildfire effects along with a program (fuels management) designed to try to reduce these impacts. Together these programs provide a significant opportunity to influence sagebrush habitats that benefit sage-grouse. Wildfire, particularly in low elevation Wyoming big sagebrush systems, has resulted in significant habitat loss primarily because of subsequent invasion by cheatgrass and other exotic plant species (Miller et al. 2011). The number of fires and total acreage burned has increased throughout the sage-grouse range (Miller et al. 2011). Long-term monitoring following prescribed fire is important because treatments may not increase either yield or nutritional quality of forbs eaten by sage-grouse, and also may decrease abundance of insects that are important for growth of sage-grouse chicks (Beck et al. 2009, Rhodes et al. 2010). Therefore, it is critical not only to conduct management actions that reduce the long-term loss of sagebrush but also to restore and recover burned areas to habitats that will be used by sage-grouse (Pyke 2011). Prescribed fire is a tool that can assist in the recovery of sagebrush habitat in some vegetation types (Davies et al. 2011).

Fuels Management

Priority sage-grouse habitat areas

- Design and implement fuels treatments with an emphasis on protecting existing sagebrush ecosystems.
    - Do not reduce sagebrush canopy cover to less than 15% (Connelly et al. 2000, Hagen et al. 2007) unless a fuels management objective requires additional reduction in sagebrush cover to meet strategic protection of priority sage-grouse habitat and conserve habitat quality for the species. Closely evaluate the benefits of the fuel break against the additional loss of sagebrush cover in the EA process.
    - Apply appropriate seasonal restrictions for implementing fuels management treatments according to the type of seasonal habitats present in a priority area.
    - Allow no treatments in known winter range unless the treatments are designed to strategically reduce wildfire risk around or in the winter range and will maintain winter range habitat quality.
    - Do not use fire to treat sagebrush in less than 12-inch precipitation zones (e.g., Wyoming big sagebrush or other xeric sagebrush species; Connelly et al. 2000, Hagen et al. 2007, Beck et al. 2009). However, if as a last resort and after all other treatment opportunities have been explored and site specific variables allow, the use of prescribed fire for fuel breaks that would disrupt the fuel continuity across the landscape could be considered, in stands where cheatgrass is a very minor component in the understory (Brown 1982).
    - Monitor and control invasive vegetation post-treatment.
    - Rest treated areas from grazing for two full growing seasons unless vegetation recovery dictates otherwise (WGFD 2011).
    - Require use of native seeds for fuels management treatment based on availability, adaptation (site potential), and probability of success (Richards et al. 1998). Where probability of success or native seed availability is low, non-native seeds may be used as long as they meet sage-grouse habitat objectives (Pyke 2011).
    - Design post fuels management projects to ensure long term persistence of seeded or pre-treatment native plants. This may require temporary or long-term changes in livestock grazing management, wild horse and burro management, travel management, or other activities to achieve and maintain the desired condition of the fuels management project (Eiswerth and Shonkwiler 2006).

- Design fuels management projects in priority sage-grouse habitat to strategically and effectively reduce wildfire threats in the greatest area. This may require fuels treatments implemented in a more linear versus block design (Launchbaugh et al. 2007).

During fuels management project design, consider the utility of using livestock to strategically reduce fine fuels (Diamond et al. 2009), and implement grazing management that will accomplish this objective Davies et al. 2011 and Launchbaugh et al. 2007). Consult with ecologists to minimize impacts to native perennial grasses.

Fire operations

- In priority sage-grouse habitat areas, prioritize suppression, immediately after life and property, to conserve the habitat.
- In general sage-grouse habitat, prioritize suppression where wildfires threaten priority sage-grouse habitat.
- Follow Best Management Practices (WO IM 2011-138, see appendix E.)

Emergency Stabilization and Rehabilitation (ES&R)

- Prioritize native seed allocation for use in sage-grouse habitat in years when preferred native seed is in short supply. This may require reallocation of native seed from ES&R projects outside of priority sage-grouse habitat to those inside it. Use of native plant seeds for ES&R seedings is required based on availability, adaptation (site potential), and probability of success Richards et al. 1998). Where probability of success or native seed availability is low, non-native seeds may be used as long as they meet sage-grouse habitat conservation objectives (Pyke 2011). Re-establishment of appropriate sagebrush species/subspecies and important understory plants, relative to site potential, shall be the highest priority for rehabilitation efforts.
- Design post ES&R management to ensure long term persistence of seeded or pre-burn native plants. This may require temporary or long-term changes in livestock grazing, wild horse and burro, and travel management, etc., to achieve and maintain the desired condition of ES&R projects to benefit sage-grouse (Eiswerth and Shonkwiler 2006).
- Consider potential changes in climate (Miller at al. 2011) when proposing post-fire seedings using native plants. Consider seed collections from the warmer component within a species' current range for selection of native seed. (Kramer and Havens 2009).

Habitat Restoration

Habitat restoration cross-cuts all programs. It is an important tool to create and/or maintain a landscape that benefits sage-grouse.

- Prioritize implementation of restoration projects based on environmental variables that improve chances for project success in areas most likely to benefit sage-grouse (Meinke et al. 2009).
    - o Prioritize restoration in seasonal habitats that are thought to be limiting sage-grouse distribution and/or abundance.
- Include sage-grouse habitat parameters as defined by Connelly et al. (2000), Hagen et al. (2007) or if available, State Sage-Grouse Conservation plans and appropriate local information in habitat restoration objectives. Make meeting these objectives within priority sage-grouse habitat areas the highest restoration priority.
- Require use of native seeds for restoration based on availability, adaptation (ecological site potential), and probability of success (Richards et al. 1998). Where probability of success or adapted seed availability is low, non-native seeds may be used as long as they support sage-grouse habitat objectives (Pyke 2011).
- Design post restoration management to ensure long term persistence. This could include changes in livestock grazing management, wild horse and burro management and travel management, etc., to achieve and maintain the desired condition of the restoration effort that benefits sage-grouse (Eiswerth and Shonkwiler 2006).
- Consider potential changes in climate (Miller et al. 2011) when proposing restoration seedings when using native plants. Consider collection from the warmer component of the species current range when selecting native species (Kramer and Havens 2009).
- Restore native (or desirable) plants and create landscape patterns which most benefit sage-grouse.
- Make re-establishment of sagebrush cover and desirable understory plants (relative to ecological site potential) the highest priority for restoration efforts.
- In fire prone areas where sagebrush seed is required for sage-grouse habitat restoration, consider establishing seed harvest areas that are managed for seed production (Armstrong 2007) and are a priority for protection from outside disturbances.

Monitoring of Sage-grouse and Sagebrush Habitats

Given the degree of uncertainty associated with managing natural resources, adaptive management approaches that include rigorous monitoring protocols to support them are essential if conservation goals are to be realized (Walters 1986, Burgman et al. 2005, Stankey et al. 2005, Turner 2005, Lyons et al. 2008). Recent efforts to develop range-wide policy and conservation measures for sage-grouse have emphasized the importance of improving monitoring efforts on both sage-grouse distribution and population trends, and the habitat they depend on (Wambolt et al. 2002, Stiver et al. 2006, Reese and Boyer 2007, Connelly et al. 2011a).

Monitoring is necessary to provide an objective appraisal of the effects of potentially positive conservation actions, and to assess the relative negative effects of management actions to sage-grouse populations and their habitats. Adaptive management planning also reveals substantial gaps in knowledge about key processes and functional relationships (Walters 1987), and therefore helps to identify and prioritize research needs. Ideally, monitoring attributes of sage-grouse habitat and sage-grouse populations will allow linking real or potential habitat changes from natural events and management actions to vital rates of sage-grouse populations (Stiver et al. 2006, Naugle and Walker 2007). Population monitoring led by State wildlife agencies and consistent long-term habitat monitoring among all jurisdictions will enable managers to identify indicators associated with population change across large landscapes and to ameliorate negative effects with appropriate conservation actions (Burgman et al. 2005, Turner 2005).

Sage-grouse select habitats at multiple scales across large landscapes (Connelly et al. 2003, Stiver et al. 2006), which monitoring strategies for sage-grouse habitats must reflect. At landscape levels (RMP level), monitoring should track percent of sagebrush and cover and maturity of stands, preservation of key seasonal habitat components, and the degree of connectivity among populations, seasonal habitats and stands. At the project level, a truly effective monitoring strategy will include measures as to how plant communities respond, how that relates to structural and other sage-grouse habitat requirements, and how sage-grouse populations respond demographically. Quantitative data for habitat measurements should be collected that are sensitive to the land use change being proposed (Stiver et al 2006). Monitoring must occur over the proper time frames to evaluate temporal variation of important components of sage-grouse habitats (Stiver et al. 2006).

Recognizing the importance of monitoring both sage-grouse habitat and populations, BLM in November 2004, completed the National Sage-Grouse Habitat Conservation Strategy (USDI BLM 2004) to address conservation and management of sage-grouse. The overarching goal was to "provide a consistent and scientifically based approach for collection and use of monitoring data for sagebrush habitats, sage-grouse and other components of the sagebrush community." Four action items were identified to accomplish this goal: 1) Develop, cooperatively with our partners, appropriate monitoring strategies and protocols at the appropriate scale for sage-grouse habitat in conjunction with the development of the range-wide conservation action plan; 2) Develop, cooperatively with our partners, a sage-grouse habitat assessment methodology in conjunction with development of the range-wide conservation action plan; 3) Incorporate the sage-grouse habitat assessment framework into the land health assessment process for evaluating indicators of healthy rangelands; and 4) In conjunction with the development of the range-wide conservation action plan, issue guidance for collecting fine-scale monitoring and assessment information and incorporating requirements into implementation projects and plans.

To date, BLM has completed portions of the above action items. In August 2010, the Sage-Grouse Habitat Assessment Framework: Multi-scale Habitat Assessment Tool was completed (Stiver et al. 2010). The assessment framework provides policy makers, resource managers, and natural resource specialists a comprehensive framework for landscape conservation in sagebrush ecosystems with an emphasis on sage-grouse. Implementation policy directing consistent use of the assessment still needs to be completed by BLM in addition to other guidance identified in the strategy.

BLM has recently completed the agency's Assessment, Inventory, and Monitoring (AIM) Strategy (Toevs 2011). The AIM strategy identifies "core indicators" for reporting landscape level attributes. The AIM strategy has resulted in BLM adopting the Natural Resource Conservation Service's National Resource Inventory (NRI) methodology as part of BLM's Landscape Monitoring Project. The NRI protocols provide BLM a statistical framework for evaluating management actions, and programs and policies at a landscape or regional level. Initial NRI data collection occurred on all lands managed by BLM during the summer of 2011. During the summer of 2012 additional NRI monitoring sites are being incorporated to evaluate sagebrush habitats that contain approximately two-thirds of the sage-grouse populations west wide. At this time, the remaining sage-grouse populations have not been identified for long-term habitat monitoring due to funding short falls. In addition to prioritizing funding to fully achieve this objective, habitat monitoring protocols at a fine scale to evaluate impacts at a project level remain to be developed.

Estimates of sage-grouse population size are not available for any population, rather trends in population size are estimated through a lek count index. Exact estimates of sage grouse abundance, while desirable, are probably less important than trends and particularly how sage grouse respond to management actions.

Counts of males attending leks in the spring have been used by wildlife agencies as the primary index to population trends since Patterson suggested that this method might be useful in 1952 (Patterson 1952). Use of convenience sampling to monitor bird populations has been criticized (Ellingson and Lukacs 2003), and lek counts in particular have been challenged as inconsistently conducted, inherently biased and without any known relationship to population size (Beck and Braun 1980, Walsh et al. 2004, Sedinger 2007). Despite limitations of the method, lek counts remain the best available information on population trends over time, and pragmatic strategies to improve population estimation remain elusive (Reese and Bowyer 2007).

It is beyond the scope of this report to develop methodology to better estimate sage-grouse distribution and abundance, but rather to emphasize that WAFWA should convene a technical group for this purpose, and that this group should consider ways to:

1. Standardize, at least within management zones, lek count methodology.
2. Develop and implement methodology to estimate the number of leks in an unbiased manner (Walsh et al. 2004, Sedinger 2007), and determine the location of new or previously unknown leks (particularly important since priority habitat designations are based in large part on locations of leks).
3. Develop and implement methodology to estimate the proportion of males detected while attending leks, and explore degree and nature of variability.
4. Develop and explore methodology to estimate sex ratios within sage-grouse populations.
5. Use Geographic Information System (GIS) mapping technology and analytical tools to track changes in distribution over time, connectivity among populations and population segments, and explore spatially explicit models that link sage-grouse population performance with ecological indicators (Naugle and Walker 2007).

The standardization of monitoring methods and implementation of a defensible monitoring approach is vital if BLM and other conservation partners are to use the resulting information to guide implementation of conservation activities (Naugle and Walker 2007). Monitoring strategies for sage-grouse habitat and populations must be collaborative, as habitat occurs across varied land ownership (52% BLM, 8% USFS, 31% private 5% state, 4% BIA and other Federal; 75 FR 13910), and state fish and wildlife agencies have primary responsibility for population level management of wildlife, including monitoring.

Acronyms

AML	Appropriate Management Level
AMP	Allotment Management Plan
APD	Application of Permit to Drill
BLM	Bureau of Land Management
BMPs	Best Management Practices
CX	Categorical Exclusion
ERMA	Extensive Recreation Management Areas
ESA	Endangered Species Act
ESD	Ecological Site Description
ES&R	Emergency Stabilization and Rehabilitation
IM	Instruction Memorandum
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NMAC	National Multi-Agency Coordination Group
NRCS	Natural Resources Conservation Service
NPT	National Policy Team
NTT	National Technical Team
RIDT	Regional Interdisciplinary Team
RMP	Resource Management Plan
RMT	Regional Management Team
ROW	Right-of-Way
SRMA	Special Recreation Management Area
SRP	Special Recreation Permit
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAFWA	Western Association of Fish and Wildlife Agencies

Glossary

2008 WAFWA Sage-grouse MOU: A memorandum of understanding (MOU) among Western Association of Fish and Wildlife Agencies, U.S. Department of Agriculture, Forest Service, U.S. Department of the Interior, Bureau of Land Management, U.S. Department of the Interior, Fish and Wildlife Service, U.S. Department of the Interior, Geological Survey, U.S. Department of Agriculture, Natural Resources Conservation Service, and the U.S. Department of Agriculture, Farm Service Agency. The purpose of the MOU is to provide for cooperation among the participating state and federal land, wildlife management and science agencies in the conservation and management of sage-grouse (*Centrocercus urophasianus*) sagebrush (*Artemisia* spp.) habitats and other sagebrush-dependent wildlife throughout the western United States and Canada and a commitment of all agencies to implement the 2006 WAFWA Conservation Strategy.

2011 Partnership MOU: A partnership agreement among the United States Department of Agriculture Natural Resource Conservation Service, Forest Service, United State Department of the Interior, Bureau of Land Management, and Fish and Wildlife Service. 2011. This MOU is for range management – to implement NRCS practices on adjacent federal properties.

Administrative Access: A term used to describe access for resource management and administrative purposes such as fire suppression, cadastral surveys, permit compliance, law enforcement and military in the performance of their official duty, or other access needed to administer BLM-managed lands or uses.

Avoidance Areas: Areas to be avoided but that may be available for location of ROWs with special stipulations.

Best Management Practices (BMPs): A suite of techniques that guide or may be applied to management actions to aide in achieving desired outcomes. BMPs are often developed in conjunction with land use plans, but they are not considered a planning decision unless the plans specify that they are mandatory.

Casual Use: Casual use means activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. For examples for rights of ways see 43 CFR 2801.5. For examples for locatable minerals see 43 CFR 3809.5.

Conservation Plan: The recorded decisions of a landowner or operator, cooperating with a conservation district, on how the landowner or operator plans, within practical limits, to use his/her land according to its capability and to treat it according to its needs for maintenance or improvement of the soil, water, animal, plant, and air resources.

Conserve: To cause no degradation or loss of sage-grouse habitat. Conserve can also refer to maintaining intact sagebrush steppe by fine tuning livestock use, watching for and treating new invasive species and maintaining existing range improvements that benefit sage-grouse etc.

Ecological Site: A distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

Exploration: Active drilling and geophysical operations to:

a. Determine the presence of the mineral resource; or
b. Determine the extent of the reservoir.

Development: Active drilling and production of wells

Development Area: Areas primarily leased with active drilling and wells capable of production in payable quantities.

Enhance: The improvement of habitat by increasing missing or modifying unsatisfactory components and/or attributes of the plant community to meet sage-grouse objectives. Examples include modifying livestock grazing systems to improve the quantity and vigor of desirable forbs, improving water flow in riparian areas by modifying existing spring developments to return more water to the riparian area below the development, or marking fences to minimize sage-grouse hits and mortality.

General Sage-grouse Habitat: Is occupied (seasonal or year-round) habitat outside of priority habitat. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Integrated Ranch Planning: A method for ranch planning that takes a holistic look at all elements of the ranching operations, including strategic and tactical planning, rather than approaching planning as several separate enterprises.

Large Scale Anthropogenic Disturbances: Features include but are not limited to paved highways, graded gravel roads, transmission lines, substations, wind turbines, oil and gas wells, geothermal wells and associated facilities, pipelines, landfills, agricultural conversion, homes, and mines.

Late Brood Rearing Area: Habitat includes mesic sagebrush and mixed shrub communities, wet meadows, and riparian habitats as well as some agricultural lands (e.g. alfalfa fields, etc).

Lek:[vi] A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Sub-dominant males may display on itinerant strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where less than five males are observed strutting should be confirmed active for two years before meeting the definition of a lek (Connelly et al 2000, Connelly et al. 2003, 2004).

Lek Complex: A lek or group of leks within 2.5 km (1.5 mi) of each other between which male sage-grouse may interchange from one day to the next. Fidelity to leks has been well documented.

[vi] Each State may have a slightly different definition of lek, active lek, inactive lek, occupied, and unoccupied leks. Regional planning will use the appropriate definition provided by the State of interest.

Visits to multiple leks are most common among yearlings and less frequent for adult males, suggesting an age-related period of establishment (Connelly et al. 2004).

Active Lek: Any lek that has been attended by male sage-grouse during the strutting season.

Inactive Lek: Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. Absence of strutting grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of either: 1) an absence of sage-grouses on the lek during at least 2 ground surveys separated by at least seven days. These surveys must be conducted under ideal conditions (April 1-May 7 (or other appropriate date based on local conditions), no precipitation, light or no wind, half-hour before sunrise to one hour after sunrise) or 2) a ground check of the exact known lek site late in the strutting season (after April 15) that fails to find any sign (tracks, droppings, feathers) of strutting activity. Data collected by aerial surveys should not be used to designate inactive status as the aerial survey may actually disrupt activities.

Occupied Lek: A lek that has been active during at least one strutting season within the prior 10 years.

Unoccupied Lek: A lek that has either been "destroyed" or "abandoned."

Destroyed Lek: A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding.

Abandoned Lek: A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the 10 years. The site of an "abandoned" lek should be surveyed at least once every 10 years to determine whether it has been re-occupied by sage-grouse.

Master Development Plans: A set of information common to multiple planned wells, including drilling plans, Surface Use Plans of Operations, and plans for future production.

Mitigation: Compensating for resource impacts by replacing or providing substitute resources or habitat.

Notice-level Mining Activities: To qualify for a Notice the mining activity must: 1) constitute exploration, 2) not involve bulk sampling of more than 1,000 tons of presumed ore, 3) must not exceed 5 acres of surface disturbance, and 4) must not occur in one of the special category lands listed in 43 CFR 3809.11(c). The Notice is to be filed in the BLM field office with jurisdiction over the land involved. The Notice does not need to be on a particular form but must contain the information required by 43 CFR 3809.301(b).

Offsite Mitigation: Compensating for resource impacts by replacing or providing substitute resources or habitat at a different location than the project area.

Plan of Operations: A Plan of Operations is required for all mining activity exploration greater than 5 acres or surface disturbance greater than casual use on certain special category lands. Special category lands are described under 43 CFR 3809.11(c) and include such lands as designated Areas of Critical Environmental Concern, lands within the National Wilderness Preservation System, and areas closed to off-road vehicles, among others. In addition, a plan of operations is required for activity greater than casual use on lands patented under the Stock Raising Homestead Act with Federal minerals where the operator does not have the written consent of the surface owner (43 CFR 3814). The Plan of operations needs to be filed in the BLM field office with jurisdiction over the land involved. The Plan of Operations does not need to be on a particular form but must address the information required by 43 CFR 3809.401(b).

Priority Sage-grouse Habitat: Areas that have been identified as having the highest conservation value to maintaining sustainable sage-grouse populations. These areas would include breeding, late brood-rearing, and winter concentration areas. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Range Improvement: The term range improvement means any activity, structure or program on or relating to rangelands which is designed to improve production of forage; change vegetative composition; control patterns of use; provide water; stabilize soil and water conditions; and provide habitat for livestock and wildlife. The term includes, but is not limited to, structures, treatment projects, and use of mechanical means to accomplish the desired results.

Roads, Primitive Roads and Trails: Roads, primitive roads or trails that have been specifically designated for motorized use through a public implementation-level National Environmental Policy Act process in accordance with 43 CFR, Part 8340.

Reclamation: Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves re-contouring, replacement of topsoil, re-vegetation, and other work necessary to ensure eventual restoration of the site.

Reference State: The reference state is the state where the functional capacities represented by soil/site stability, hydrologic function, and biotic integrity are performing at an optimum level under the natural disturbance regime. This state usually includes, but is not limited to, what is often referred to as the potential natural plant community.

Restoration: Implementation of a set of actions that promotes plant community diversity and structure that allows plant communities to be more resilient to disturbance and invasive species over the long term. The long-term goal is to create functional, high quality habitat that is occupied by sage-grouse. Short-term goal may be to restore the landform, soils and hydrology and increase the percentage of preferred vegetation, seeding of desired species, or treatment of undesired species.

State: A state is comprised of an integrated soil and vegetation unit having one or more biological communities that occur on a particular ecological site and that are functionally similar with respect to the three attributes (soil/site stability, hydrologic function, and biotic integrity) under natural disturbance regimes.

Stochastic: Randomly determined event, chance event, a condition determined by predictable processes and a random element.

Surface Disruption: Resource uses and activities that are likely to alter the behavior of, displace, or cause stress to sage-grouse occurring at a specific location and/or time. Surface disruption includes those actions that alter behavior or cause the displacement of sage-grouse such that reproductive success is negatively affected, or the physiological ability to cope with environmental stress is compromised. Examples of disruptive activities may include noise, vehicle traffic, or other human presence regardless of the associated activity.

Surface Disturbance: Suitable habitat is considered disturbed when it is removed and unavailable for immediate sage-grouse use.

a. Long-term removal occurs when habitat is physically removed through activities that replace suitable habitat with long term occupancy of unsuitable habitat such as a road, powerline, well pad or active mine. Long-term removal may also result from any activities that cause soil mixing, soil removal, and exposure of the soil to erosive processes.

b. Short–term removal occurs when vegetation is removed in small areas, but restored to suitable habitat within a few years (< 5) of disturbance, such as a successfully reclaimed pipeline, or successfully reclaimed drill hole or pit.

c. Suitable habitat rendered unusable due to numerous anthropogenic disturbances

d. Anthropogenic surface disturbance are surface disturbances meeting the above definitions which result from human activities.

Transition: A shift between two states. Transitions are not reversible by simply altering the intensity or direction of factors that produced the change. Instead, they require new inputs such as revegetation or shrub removal. Practices, such as these, that accelerate succession are often expensive to apply.

Unitization: Operation of multiple leases as a single lease under a single operator

Wildcat Well: An exploratory oil well drilled in land not known to be an oil field.

Wildland Fire: Any non-structure fire that occurs in the vegetation and/or natural fuels. Includes both prescribed fire and wildfire (NWCG Memo #024-2010 April 30, 2010. www.nwcg.gov).

Winter Concentration Areas: Sage-grouse winter habitats which are occupied annually by sage-grouse and provide sufficient sagebrush cover and food to support birds throughout the entire winter (especially periods with above average snow cover). Many of these areas support several different breeding populations of sage-grouse. Sage-grouse typically show high fidelity for these areas, and loss or fragmentation can result in significant population impacts.

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Other Federal, State and Interagency Memorandums/Reports

WAFWA Sage-grouse Strategy MOU, 2008

Appendices

Appendix A. Life History Requirements of Greater Sage-grouse (excerpted from 75 FR 13910)

Greater sage-grouse depend on a variety of shrub-steppe habitats throughout their life cycle, and are considered obligate users of several species of sagebrush (e.g., *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush), *A. t.* ssp. *vaseyana* (mountain big sagebrush), and *A. t. tridentata* (basin big sagebrush)) (Patterson 1952, Braun et al. 1976, Connelly et al. 2000a, Connelly et al. 2004, Miller et al. 2011). Greater sage-grouse also use other sagebrush species such as *A. arbuscula* (low sagebrush), *A. nova* (black sagebrush), *A. frigida* (fringed sagebrush), and *A. cana* silver sagebrush (Schroeder et al. 1999, Connelly et al. 2004,). Thus, sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats (Schroeder et al. 2004). Sage-grouse exhibit strong site fidelity (loyalty to a particular area even when the area is no longer of value) to seasonal habitats, which includes breeding, nesting, brood rearing, and wintering areas (Connelly et al. 2004, Connelly et al. 2011b). Adult sage-grouse rarely switch between these habitats once they have been selected, limiting their adaptability to changes.

During the spring breeding season, male sage-grouse gather together to perform courtship displays on areas called leks. The proximity, configuration, and abundance of nesting habitat are key factors influencing lek location (Connelly et al., 1981, and Connelly et al., 2000b, cited in Connelly et al., 2011). Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly et al. 2000a) and, therefore, lek habitat availability is not considered to be a limiting factor for sage-grouse (Schroeder et al. 1999). Nest sites are selected independent of lek locations, but the reverse is not true (Bradbury et al. 1989,Wakkinen et al. 1992). Thus, leks are indicative of nesting habitat.

Females have been documented to travel more than 20 km (12.5 mi) to their nest site after mating (Connelly et al. 2000a), but distances between a nest site and the lek on which breeding occurred is variable (Connelly et al. 2004, Connelly et al. 2011b). Average distance between a female's nest and the lek on which she was first observed ranged from 3.4 km (2.1 mi) to 7.8 km (4.8 mi) in five studies examining 301 nest locations (Schroeder et al. 1999).

Productive nesting areas are typically characterized by sagebrush with an understory of native grasses and forbs, with horizontal and vertical structural diversity that provides an insect prey base, herbaceous forage for pre-laying and nesting hens, and cover for the hen while she is incubating (Gregg 1991Schroeder et al. 1999, Connelly et al. 2000a, Connelly et al. 2004, Connelly et al. 2011b). Sage-grouse also may use other shrub or bunchgrass species for nest sites (Klebenow 1969, Connelly et al. 2000a, Connelly et al. 2004). Shrub canopy and grass cover provide concealment for sage-grouse nests and young, and are critical for reproductive success (Barnett and Crawford 1994, Gregg et al. 1994, DeLong et al.1995, Connelly et al. 2004).

Hens rear their broods in the vicinity of the nest site for the first 2-3 weeks following hatching (within 0.2-5 km (0.1-3.1 mi)), based on two studies in Wyoming (Connelly et al. 2004). Forbs and insects are essential nutritional components for chicks (Klebenow and Gray 1968, Johnson and Boyce 1991, Connelly et al. 2004). Therefore, early brood-rearing habitat must provide adequate cover (sagebrush canopy cover of 10 to 25 percent; Connelly et al. 2000a) adjacent to areas rich in forbs and insects to ensure chick survival during this period (Connelly et al. 2004, Hagen et al. 2007).

All sage-grouse gradually move from sagebrush uplands to more mesic areas (moist areas such as streambeds or wet meadows) during the late brood-rearing period (3 weeks post-hatch) in response to summer desiccation of herbaceous vegetation (Connelly et al. 2000a). Summer use areas can include sagebrush habitats as well as riparian areas, wet meadows and alfalfa fields (Schroeder et al. 1999). These areas provide an abundance of forbs and insects for both hens and chicks (Schroeder et al. 1999, Connelly et al. 2000a).

As vegetation continues to desiccate through the late summer and fall, sage-grouse shift their diet entirely to sagebrush (Schroeder et al. 1999). Sage-grouse depend entirely on sagebrush throughout the winter for both food and cover (Connelly et al. 2011a). Sagebrush stand selection is influenced by snow depth (Patterson 1952, Hupp and Braun 1989), availability of sagebrush above the snow to provide cover (Connelly et al. 2004, and references therein) and, in some areas, topography (e.g., elevation, slope and aspect, Beck 1977, Crawford et al. 2004).

Many populations of sage-grouse migrate between seasonal ranges in response to habitat distribution (Connelly et al. 2004). Migration can occur between winter and breeding and summer areas, between breeding, summer and winter areas, or not at all. Migration distances of up to 161 km (100 mi) have been recorded (Patterson 1952), however, distances vary depending on the locations of seasonal habitats (Schroeder et al. 1999). Migration distances for female sage-grouse generally are less than for males (Connelly et al. 2004), but in one study in Colorado, females travelled further than males (Beck 1977). Almost no information is available regarding the distribution and characteristics of migration corridors for sage-grouse (Connelly et al. 2004). Sage-grouse dispersal (permanent moves to other areas) is poorly understood (Connelly et al. 2004, Knick and Hanser 2011) and appears to be sporadic (Dunn and Braun 1986). Estimating an "average" home range for sage-grouse is difficult due to the large variation in sage-grouse movements both within and among populations. This variation is related to the spatial availability of habitats required for seasonal use and annual recorded home ranges have varied from 4 to 615 square kilometers (km^2) (1.5 to 237.5 square miles (mi^2)), Connelly et al. *2011b*).

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Appendix B. Scientific Inference

When making natural resource management decisions, managers desire a high level of certainty that their management actions will have the anticipated outcome (Ratti and Garton 1994, Garton et al. 2005). Unfortunately, natural systems have inherent complexity and stochasticity that make certainty in wildlife management decisions challenging (Williams et al. 2002). In an effort to ameliorate some of this uncertainty, managers use quality, published scientific investigations which are reliant upon thoughtful research design (Ratti and Garton 1994, Garton et al. 2005) to guide population and habitat management decisions. When relevant peer reviewed literature does not exist, managers have to resort to best professional judgment and/or unpublished studies. In addition, when using published and unpublished literature, managers must also be cognizant of the research findings for certainty of the conclusions, the scientific method, and if the findings can be applied from the data and results (Murphy and Noon 1991).

Most wildlife research is located along a continuum of field studies (Ratti and Garton 1994, Garton et al. 2005; Fig. 1) and provides varying degrees of reliable knowledge (Romesburg 1981, Hurlbert, 1984, Eberhardt and Thomas 1991). The more rigorous the research design, results, and conclusions, the more confident managers can be in the anticipated outcome (Ratti and Garton 1994, Garton et al. 2005). Research that bases its results and interpretation on an integrated research process includes field level experiments, field study, and modeling (Fig. 1). If designed appropriately, these research efforts can provide for a more broad-based application of research results as opposed to descriptive natural history studies (Ratti and Garton 1994, Garton et al. 2005) (Fig. 1).

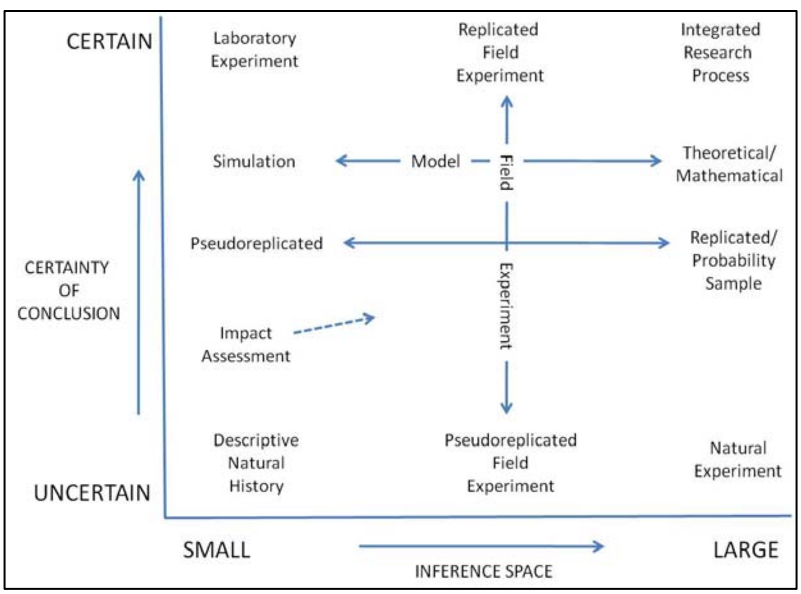

Figure 1. The spectrum of types of wildlife studies that can produce results and conclusions with a large amount of certainty over a very large area of applicability (adapted from Ratti and Garton 1994 and Garton et al. 2005).

Because sage-grouse research has been on-going for over 60 years, managers have access to published literature from several studies (metareplication (Johnson 2002)) that includes different years, study areas, methods, and investigators (Johnson 2002) which leads to more certainty in conclusions (for example see Hagen et al. 2007). In contrast, for some management actions, access to published and unpublished literature may be limited to a single descriptive study. A single descriptive study and/or professional judgment has the lowest level of certainty and lowest inference space. Unfortunately, it may be the only information available on the subject. Ultimately, the result is succinctly summarized by Anderson et al. (2001:312) who stated, "In the long run, science is safeguarded by repeated studies to ascertain what is real and what is merely a spurious result from a single study."

Management in sagebrush ecosystems is further complicated by new forms of development or the unprecedented pace at which traditional uses are increasing. Wind and other renewable energy sources are being proposed and developed in areas that previously had undergone little development. The applicability of results from previous research in other regions on oil and gas development to these new forms of land use is unknown, but is the best information currently available. We also do not know how sagebrush and sage-grouse respond to the increasing intensity of all uses ranging from traditional commodity development to nonconsumptive activities, such as recreation and OHV travel that is occurring across their range. Although previous research can guide management decisions, the changes due to the cumulative effect of this new level of increased development may take years to be fully expressed in habitat and population response.

No single research study, or even a series of studies, regardless of design, and/or inference extent can provide complete certainty in their conclusion(s). As a result, managers must be vigilant in their judgment of research study design, its inference space, and applicability to their management issue when making management decisions. This report cites a large number of published and unpublished studies that can be placed along the continuum of certainty of conclusion and inference space (Fig. 1). Many of the studies cited are from different researchers, study sites, methodologies, and/or years which assists and improves the certainty of the conclusion and inference space (Fig. 1), but ultimately, it is incumbent upon managers to assess their level of risk (consequences of being wrong) with management decisions based upon the cited findings.

The large spatial scales occupied by sage-grouse seasonally (as much as 1,700 mi^2; Leonard et al. 2000) have made research on how they respond to habitat perturbations difficult to conduct. Although strength of inference is strongest for replicated experiments, studies of this nature have not been conducted on large scale perturbations such as oil and gas developments, wind farms, coal mines, powerlines, etc. We therefore relied on retrospective and correlational studies that looked at changes in sage-grouse distribution, abundance or demographic rates over time following these developments. We gave greater credence to conclusions obtained from multiple studies conducted at different locations at different times that showed similar results.

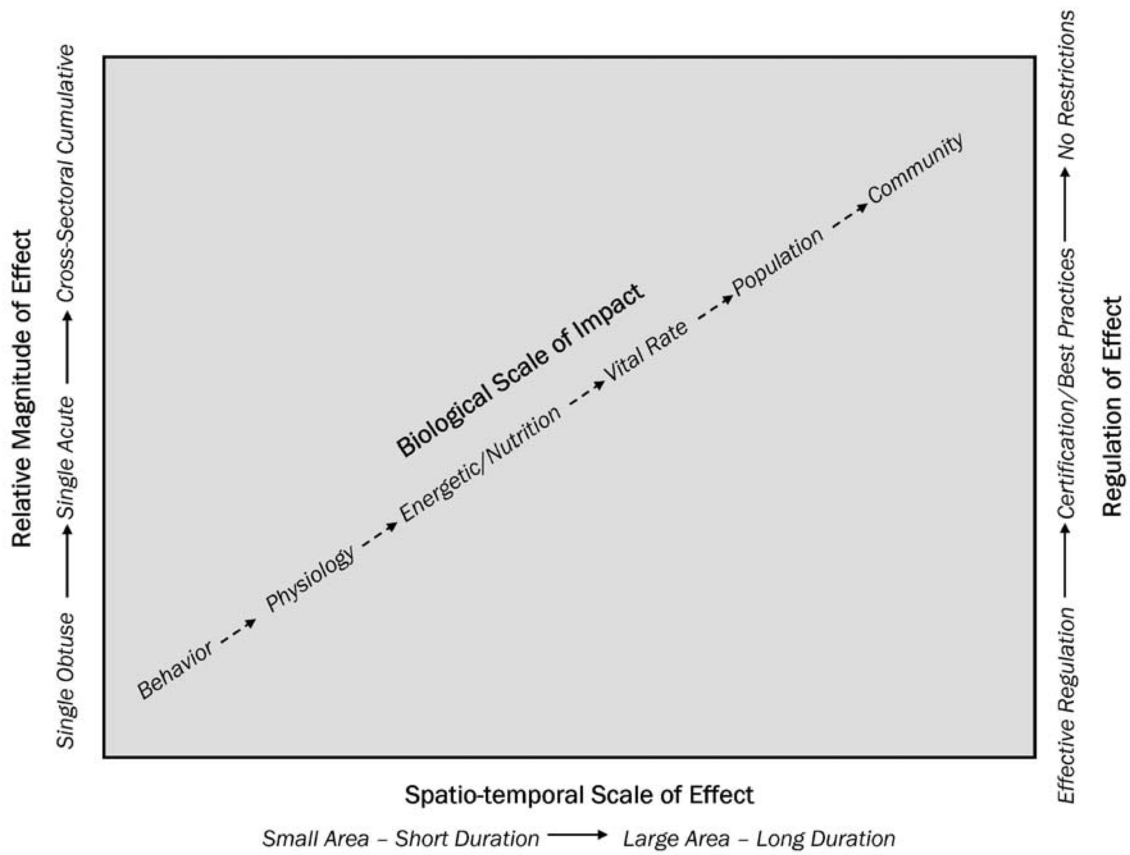

Figure 2. Schematic representation of a typology for classifying and predicting the impacts of human-wildlife interactions (as modified from Johnson and St-Laurent 2011).

Conservation measures described in this report are derived from interpretation of the best available scientific studies using our best professional judgment. Because there is a degree of uncertainty about the effectiveness of these conservation measures, we recommend a rigorous adaptive management process be employed, with population and habitat monitoring as well as feedback loops so that conservation measures or policies that are ineffective can be changed (Lyons et al. 2008).

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Appendix C. BMPs for how to make a pond that won't produce mosquitoes that transmit West Nile virus (from Doherty (2007)).

The following are seven distinct site modifications that if adhered to, would minimize exploitation of CBNG ponds by *Culex tarsalis*:

1. Increase the size of ponds to accommodate a greater volume of water than is discharged. This will result in un-vegetated and muddy shorelines that breeding *Cx. tarsalis* avoid (De Szalay and Resh 2000). This modification may reduce *Cx. tarsalis* habitat but could create larval habitat for *Culicoides sonorensis*, a vector of blue tongue disease, and should be used sparingly (Schmidtmann et al. 2000). Steep shorelines should be used in combination with this technique whenever possible (Knight et al. 2003).

2. Build steep shorelines to reduce shallow water (>60 cm) and aquatic vegetation around the perimeter of impoundments (Knight et al. 2003). Construction of steep shorelines also will create more permanent ponds that are a deterrent to colonizing mosquito species like *Cx. tarsalis* which prefer newly flooded sites with high primary productivity (Knight et al. 2003).

3. Maintain the water level below that of rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Avoid flooding terrestrial vegetation in flat terrain or low lying areas. Aquatic habitats with a vegetated inflow and outflow separated by open water produce 5-10 fold fewer Culex mosquitoes than completely vegetated wetlands (Walton and Workman 1998). Wetlands with open water also had significantly fewer stage III and IV instars which may be attributed to increased predator abundances in open water habitats (Walton and Workman 1998).

4. Construct dams or impoundments that restrict down slope seepage or overflow by digging ponds in flat areas rather than damming natural draws for effluent water storage, or lining constructed ponds in areas where seepage is anticipated (Knight et al. 2003).

5. Line the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.

6. Line the overflow spillway with crushed rock, and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation.

7. Fence pond site to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure and create hoof print pockets of water that are attractive to breeding mosquitoes.

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Appendix D. Best Management Practices for Fluid Mineral Development

Priority Habitats - BMPs are continuously improving as new science and technology become available and therefore are subject to change. Include from the following BMPs those that are appropriate to mitigate effects from the approved action.

Roads

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Locate roads to avoid important areas and habitats.
- Coordinate road construction and use among ROW holders.
- Construct road crossing at right angles to ephemeral drainages and stream crossings.
- Establish speed limits on BLM system roads to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.
- Establish trip restrictions (Lyon and Anderson 2003) or minimization through use of telemetry and remote well control (e.g., Supervisory Control and Data Acquisition).
- Do not issue ROWs to counties on newly constructed energy development roads, unless for a temporary use consistent with all other terms and conditions included in this document.
- Restrict vehicle traffic to only authorized users on newly constructed routes (use signing, gates, etc.)
- Use dust abatement practices on roads and pads.
- Close and rehabilitate duplicate roads.

Operations

- Cluster disturbances, operations (fracture stimulation, liquids gathering, etc.), and facilities.
- Use directional and horizontal drilling to reduce surface disturbance.
- Place infrastructure in already disturbed locations where the habitat has not been restored.
- Consider using oak (or other material) mats for drilling activities to reduce vegetation disturbance and for roads between closely spaced wells to reduce soil compaction and maintain soil structure to increase likelihood of vegetation reestablishment following drilling.
- Apply a phased development approach with concurrent reclamation.
- Place liquid gathering facilities outside of priority areas. Have no tanks at well locations within priority areas (minimizes perching and nesting opportunities for ravens and raptors and truck traffic). Pipelines must be under or immediately adjacent to the road (Bui et al. 2010).

- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Site and/or minimize linear ROWs to reduce disturbance to sagebrush habitats.
- Place new utility developments (power lines, pipelines, etc.) and transportation routes in existing utility or transportation corridors.
- Bury distribution power lines.
- Corridor power, flow, and small pipelines under or immediately adjacent to roads.
- Design or site permanent structures which create movement (e.g. a pump jack) to minimize impacts to sage-grouse.
- Cover (e.g., fine mesh netting or use other effective techniques) all drilling and production pits and tanks regardless of size to reduce sage-grouse mortality.
- Equip tanks and other above ground facilities with structures or devices that discourage nesting of raptors and corvids.
- Control the spread and effects of non-native plant species (Evangelista et al. 2011). (E.g. by washing vehicles and equipment.)
- Use only closed-loop systems for drilling operations and no reserve pits.
- Restrict pit and impoundment construction to reduce or eliminate threats from West Nile virus (Doherty 2007).
- Remove or re-inject produced water to reduce habitat for mosquitoes that vector West Nile virus. If surface disposal of produced water continues, use the following steps for reservoir design to limit favorable mosquito habitat:
  - Overbuild size of ponds for muddy and non-vegetated shorelines.
  - Build steep shorelines to decrease vegetation and increase wave actions.
  - Avoid flooding terrestrial vegetation in flat terrain or low lying areas.
  - Construct dams or impoundments that restrict down slope seepage or overflow.
  - Line the channel where discharge water flows into the pond with crushed rock.
  - Construct spillway with steep sides and line it with crushed rock.
  - Treat waters with larvicides to reduce mosquito production where water occurs on the surface.
- Limit noise to less than 10 decibels above ambient measures (20-24 dBA) at sunrise at the perimeter of a lek during active lek season (Patricelli et al. 2010, Blickley et al. *In preparation*).
- Require noise shields when drilling during the lek, nesting, broodrearing, or wintering season.
- Fit transmission towers with anti-perch devices (Lammers and Collopy 2007).

- Require sage-grouse-safe fences.
- Locate new compressor stations outside priority habitats and design them to reduce noise that may be directed towards priority habitat.
- Clean up refuse (Bui et al. 2011).
- Locate man camps outside of priority habitats.

Reclamation

- Include objectives for ensuring habitat restoration to meet sage-grouse habitat needs in reclamation practices/sites (Pyke 2011). . Address post reclamation management in reclamation plan such that goals and objectives are to protect and improve sage-grouse habitat needs.
- Maximize the area of interim reclamation on long-term access roads and well pads including reshaping, topsoiling and revegetating cut and fill slopes.
- Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community.
- Irrigate interim reclamation if necessary for establishing seedlings more quickly.
- Utilize mulching techniques to expedite reclamation and to protect soils.

General sage-grouse habitat

Best Management Practices

Make applicable BMPs mandatory as Conditions of Approval within general sage-grouse habitat. BMPs are continuously improving as new science and technology become available and therefore are subject to change. At a minimum include the following BMPs:

Roads

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Do not issue ROWs to counties on energy development roads, unless for a temporary use consistent with all other terms and conditions included in this document.
- Establish speed limits to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.
- Coordinate road construction and use among ROW holders.
- Construct road crossing at right angles to ephemeral drainages and stream crossings.
- Use dust abatement practices on roads and pads.

- Close and reclaim duplicate roads, by restoring original landform and establishing desired vegetation.

Operations

- Cluster disturbances, operations (fracture stimulation, liquids gathering, etc.), and facilities.
- Use directional and horizontal drilling to reduce surface disturbance.
- Clean up refuse (Bui et al. 2010).
- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Cover (e.g., fine mesh netting or use other effective techniques) all drilling and production pits and tanks regardless of size to reduce sage-grouse mortality.
- Equip tanks and other above ground facilities with structures or devices that discourage nesting of raptors and corvids.
- Use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use.
- Control the spread and effects from non-native plant species. (e.g. by washing vehicles and equipment.)
- Restrict pit and impoundment construction to reduce or eliminate augmenting threats from West Nile virus (Dougherty 2007).

Reclamation

- Include restoration objectives to meet sage-grouse habitat needs in reclamation practices/sites (Pyke 2011). Address post reclamation management in reclamation plan such that goals and objectives are to enhance or restore sage-grouse habitat.

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Appendix E. Best Management Practices for Locatable Mineral Development

BMPs are continuously improving as new science and technology become available and therefore are subject to change. Include from the following BMPs those that are appropriate to mitigate effects from the approved action.

Roads

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Locate roads to avoid important areas and habitats.
- Coordinate road construction and use among ROW holders.
- Construct road crossing at right angles to ephemeral drainages and stream crossings.
- Establish speed limits on BLM system roads to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.
- Do not issue ROWs to counties on mining development roads, unless for a temporary use consistent with all other terms and conditions included in this document.
- Restrict vehicle traffic to only authorized users on newly constructed routes (e. g., use signing, gates, etc.)
- Use dust abatement practices on roads and pads.
- Close and reclaim duplicate roads, by restoring original landform and establishing desired vegetation.

Operations

- Cluster disturbances associated with operations and facilities as close as possible.
- Place infrastructure in already disturbed locations where the habitat has not been restored.
- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Site and/or minimize linear ROWs to reduce disturbance to sagebrush habitats.
- Place new utility developments (power lines, pipelines, etc.) and transportation routes in existing utility or transportation corridors.
- Bury power lines.
- Cover (e.g., fine mesh netting or use other effective techniques) all pits and tanks regardless of size to reduce sage-grouse mortality.
- Equip tanks and other above ground facilities with structures or devices that discourage nesting of raptors and corvids.

- Control the spread and effects of non-native plant species (Gelbard and Belnap 2003, Bergquist et al. 2007).
- Restrict pit and impoundment construction to reduce or eliminate threats from West Nile virus (Doherty 2007).
- Remove or re-inject produced water to reduce habitat for mosquitoes that vector West Nile virus. If surface disposal of produced water continues, use the following steps for reservoir design to limit favorable mosquito habitat:
  - Overbuild size of ponds for muddy and non-vegetated shorelines.
  - Build steep shorelines to decrease vegetation and increase wave actions.
  - Avoid flooding terrestrial vegetation in flat terrain or low lying areas.
  - Construct dams or impoundments that restrict down slope seepage or overflow.
  - Line the channel where discharge water flows into the pond with crushed rock.
  - Construct spillway with steep sides and line it with crushed rock.
  - Treat waters with larvicides to reduce mosquito production where water occurs on the surface.
- Require sage-grouse-safe fences around sumps.
- Clean up refuse (Bui et al. 2010).
- Locate man camps outside of priority sage-grouse habitats.

Reclamation

- Include restoration objectives to meet sage-grouse habitat needs in reclamation practices/sites. Address post reclamation management in reclamation plan such that goals and objectives are to protect and improve sage-grouse habitat needs.
- Maximize the area of interim reclamation on long-term access roads and well pads including reshaping, topsoiling and revegetating cut and fill slopes.
- Restore disturbed areas at final reclamation to pre-disturbance landform and desired plant community.
- Irrigate interim reclamation as necessary during dry periods.

Utilize mulching techniques to expedite reclamation.

Literature Cited:

Bergquist, E., P. Evangelista, T. J. Stohlgren, and N. Alley. 2007. Invasive species and coal bed methane development in the Powder River Basin, Wyoming. Environmental Monitoring and Assessment 128:381-394.

Bui, T.D., J.M. Marzluff, and B. Bedrosian. 2010. Common raven activity in relation to land use in western Wyoming: implications for greater sage-grouse reproductive success. Condor 112:65-78.

Doherty, M.K. 2007. Mosquito populations in the Powder River Basin, Wyoming: a comparison of natural, agricultural and effluent coal bed natural gas aquatic habitats. Thesis. Montana State University, Bozeman, U.S.A.

Gelbard, J.L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology 17:420-432.

Appendix F. Best Management Practices for Fire & Fuels (wo IM 2011-138)

Fuels Management BMPs:

1. Where applicable, design fuels treatment objective to protect existing sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patters which most benefit sage-grouse habitat.

2. Provide training to fuels treatment personnel on sage-grouse biology, habitat requirements, and identification of areas utilized locally.

3. Use fire prescriptions that minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable perennial plant species and reduce risk of hydrophobicity).

4. Ensure proposed sagebrush treatments are planned with interdisciplinary input from BLM and /or state wildlife agency biologist and that treatment acreage is conservative in the context of surrounding sage-grouse seasonal habitats and landscape.

5. Where appropriate, ensure that treatments are configured in a manner (e.g., strips) that promotes use by sage-grouse (See Connelly et al., 2000*)

6. Where applicable, incorporate roads and natural fuel breaks into fuel break design.

7. Power-wash all vehicles and equipment involved in fuels management activities prior to entering the area to minimize the introduction of undesirable and/or invasive plant species.

8. Design vegetation treatment in areas of high frequency to facilitate firefighting safety, reduce the risk of extreme fire behavior; and to reduce the risk and rate of fire spread to key and restoration habitats.

9. Give priority for implementing specific sage-grouse habitat restoration projects in annual grasslands first to sites which are adjacent to or surrounded by sage-grouse key habitats. Annual grasslands are second priority for restoration when the sites not adjacent to key habitat, but within 2 miles of key habitat. The third priority for annual grasslands habitat restoration projects are sites beyond 2 miles of key habitat. The intent is to focus restoration outward from existing, intact habitat.

10. As funding and logistics permit, restore annual grasslands to a species composition characterized by perennial grasses, forbs, and shrubs.

11. Emphasize the use of native plant species, recognizing that non-native species may be necessary depending on the availability of native seed and prevailing site conditions.

12. Remove standing and encroaching trees within at least 100 meters of occupied sage-grouse leks and other habitats (e.g., nesting, wintering, and brood rearing) to reduce the availability of perch sites for avian predators, as appropriate, and resources permit.

13. Protect wildland areas from wildfire originating on private lands, infrastructure corridors, and recreational areas.

14. Reduce the risk of vehicle or human-caused wildfires and the spread of invasive species by planting perennial vegetation (e.g., green-strips) paralleling road rights-of-way.

15. Strategically place and maintain pre-treated strips/areas (e.g., mowing, herbicide application, and strictly managed grazed strips) to ail in controlling wildfire should wildfire occur near key habitats or important restoration areas (such as where investments in restoration have already been made).

Fire Management BMPs:

1. Develop state-specific sage-grouse toolboxes containing maps, a list of resource advisors, contact information, local guidance, and other relevant information.

2. Provide localized maps to dispatch offices and extended attack incident commanders for use in prioritizing wildfire suppression resources and designing suppression tactics.

3. Assign a sage-grouse resource advisor to all extended attack fires in or near key sage-grouse habitat areas. Prior to the fire season, provide training to sage-grouse resource advisors on wildfire suppression organization, objectives, tactics, and procedures to develop a cadre of qualified individuals.

4. On critical fire weather days, pre-position additional fire suppression resources to optimize a quick and efficient response in sage-grouse habitat areas.

5. During periods of multiple fires, ensure line officers are involved in setting priorities.

6. To the extent possible, locate wildfire suppression facilities (i.e., base camps, spike camps, drop points, staging areas, heli-bases) in areas where physical disturbance to sage-grouse habitat can be minimized. These include disturbed areas, grasslands, near roads/trails or in other areas where there is existing disturbance or minimal sagebrush cover.

7. Power-wash all firefighting vehicles, to the extent possible, including engines, water tenders, personnel vehicles, and ATVs prior to deploying in or near sage-grouse habitat areas to minimize noxious weed spread.

8. Minimize unnecessary cross-country vehicle travel during fire operations in sage-grouse habitat.

9. Minimize burnout operations in key sage-grouse habitat areas by constructing direct fireline whenever safe and practical to do so.

10. Utilize retardant and mechanized equipment to minimize burned acreage during initial attack.

11. As safety allows, conduct mop-up where the black adjoins unburned islands, dog legs, or other habitat features to minimize sagebrush loss.

Literature Cited:

Connelly, J.W., M.A Schroeder, A.R. Sands, and C.E. Braun 2000. Guidelines to Manage Sage-grouse Populations and Their Habitats. Wildlife Society Bulletin 28:967-985.

Appendix G. National Technical Team Members

Raul Morales	*BLM, Nevada* (Team Lead)
Tony Apa	*Colorado Fish, Wildlife and Parks*
Charlie Beecham	*BLM, Colorado*
Travis Bargsten	*BLM, Wyoming*
Pat Deibert	*U.S. Fish and Wildlife*
Shawn Espinosa	*Nevada Department of Wildlife*
Mary Fiagerlle	*BLM, Nevada*
Tim Griffiths	*Natural Resources Conservation Service*
Christian Hagan	*Oregon Dept. of Fish and Wildlife*
Doug Havlina	*BLM, National Interagency Fire Center*
Don Kemner	*Idaho Fish and Game*
Steve Knick	*U.S. Geological Survey*
Ben Kniola	*BLM, Washington Office-310*
Lauren Mermejo	*BLM, Utah*
Dave Naugle	*Natural Resources Conservation Service*
Mike Pellant	*BLM, Nevada*
Rob Perrin	*BLM, Washington Office-250*
Frank Quamen	*BLM, National Operations Center*
Tom Rinkes	*BLM, Idaho*
Jason Robinson	*Utah Department of Wildlife Resources*
Jeff Rose	*BLM, Oregon*
Robin Sell	*BLM, Colorado*
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May 27, 2014

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Via: 368corridors@blm.gov

Re: Recommendations Related to the Request for Information: West-wide Energy Corridors Review

Dear Mr. Nedd, Mr. Tooke, Mr. Rosenbaum and Mr. Fusilier:

Please accept these comments on behalf of The Wilderness Society, Oregon Natural Desert Association, National Parks Conservation Association, Southern Utah Wilderness Alliance, Defenders of Wildlife, Klamath Siskiyou Wildlands Center, Conservation Colorado, Idaho Conservation League, Arizona Wilderness Coalition, Bark, Audubon Rockies, Natural Resources Defense Council, Wild Earth Guardians, Wyoming Wilderness Association, and Sonoran Institute. We appreciate the opportunity to provide comments on the review process.

The Bureau of Land Management (BLM) and the Department of Interior (DOI) have made significant progress towards establishing a responsible renewable energy program through the Western Solar Energy Program, the Regional Mitigation Manual, the Energy and Climate Change Task Force report on improving mitigation practices at DOI, and other ongoing policy initiatives. Progress is also being made on oil and gas through the leasing reforms and development of Master Leasing Plans. A landscape-scale approach built upon the "mitigation hierarchy" of first avoiding, then minimizing, and finally mitigating or "off-setting" impacts has been a key element of all of these efforts and is a priority for DOI. These and other policies are already providing benefits including better protection of wildlands and wildlife habitat and increased efficiency and predictability for developers.

BLM, the U.S. Forest Service, and the Department of Energy (the Agencies) have an opportunity to make similar and equally important advances for transmission and pipeline development on public lands through the re-evaluation and improvement of the West-wide Energy Corridors (WWEC). We believe that creation of a truly useful system of corridors that helps us meet our clean energy goals (including President Obama's goal of permitting 20,000 megawatts of renewable energy on our public lands and waters by 2020) while protecting our natural heritage is well within the agencies reach. Success will require that the agencies maintain their focus on meeting the terms of the Settlement Agreement (included as **Attachment 1**).[1]

Our organizations support appropriately-sited large-scale renewable energy development in the western states to help wean our country off of damaging fossil fuels and combat the effects of climate change on natural and human communities. Areas with important wildlands and wildlife habitat are not appropriate for development and should be protected. States like California and Colorado have ambitious requirements to generate a substantial amount of electricity from renewable energy. This should include distributed generation in urban areas, but it will also include the development of large-scale projects that will be accessed by transmission corridors including the WWEC. It is within this context that we are submitting these comments, recognizing the need for corridors to transmit renewable energy to urban areas.

We recognize that in some cases new WWEC may be necessary for transport of renewable energy, but we strongly emphasize our preference for the modification and use of existing, relatively non-controversial[2] transmission corridors to serve as WWEC instead of development of new corridors under the ongoing WWEC process.

Summary of Recommendations

1. The agencies should ensure the corridors are functional so that they are *used* by developers, thus limiting impacts from transmission and pipeline development and accessing renewable energy. This requires going beyond improving the locations of the WWEC to also addressing other issues such as non-federal lands the WWEC may cross, incentivizing development in the corridors, and capitalizing on near-term opportunities to improve the corridors through ongoing land use planning efforts.

2. The agencies should identify western Arizona, Southern Nevada and the California Desert as a priority region for review because of the abundance of important unfragmented wildlands and wildlife habitat that should be protected and the region's importance for renewable energy development.

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[1]The Settlement Agreement resulted in the dismissal of the case *The Wilderness Society, et al. v. United States Department of the Interior, et al., No. 3:09-cv-03048-JW (N.D. Cal.).*
[2] I.e., those corridors that are not recognized "corridors of concern" or are otherwise under dispute via the RFI comment period or other ongoing transmission planning efforts.

3. The agencies should assess the existing and potential future WWEC to justify if and how they will facilitate appropriately-sited renewable energy development and analyze the WWEC to identify and address environmental conflicts. This assessment should include new and relevant data for transmission needs and potential environmental impacts; an improved screening and analysis process for WWEC using BLM Arizona's Restoration Design Energy Project as a model; screening and analysis on non-federal lands the WWEC may cross; engagement in other relevant planning efforts; and a robust stakeholder outreach program.

4. The agencies should improve the Interagency Operating Procedures by incorporating the Design Features from the BLM Solar Programmatic Environmental Impact Statement.

5. The agencies should make specific changes to the WWEC to better avoid environmental conflicts and impacts and access renewable energy.

6. The agencies should involve counties and communities affected by the WWEC in meaningful ways. We have detailed some suggestions below. We cannot overstate the importance of early consultation and coordination with counties and communities that are affected by WWEC to determine the best means for meaningful public engagement in specific communities.

1. **Making the WWEC Functional**

As described above, we believe that a functional and responsible system of WWEC can help protect wildlands and wildlife habitat and help us meet our clean energy needs. Creating a functional system of WWEC requires making changes to corridors to better avoid environmentally sensitive areas and better access areas with high renewable energy potential that do not pose significant conflicts with wildlife and other resources. It also requires making the corridors useful to transmission project developers so that they propose and build projects in the corridors and not outside of them in inappropriate locations. The work required by the Settlement Agreement should make them more useful to developers by reducing conflict and controversy associated with project proposals. This work includes improving: stakeholder outreach, the locations of the corridors, Interagency Operating Procedures, and guidance and training for field staff; these comments include recommendations for successfully conducting many of these efforts. Additional work is necessary, however, to make the WWEC truly functional, and thus used in the manner in which they are intended.

Recommendations: In addition to the efforts listed above, the agencies should also analyze the non-federal segments of the corridors to identify potential conflicts and suggest possible solutions. The agencies should also incentivize development in the WWEC that are not under dispute (i.e., those corridors that have not already been identified as "Corridors of Concern" per the Settlement Agreement or about which we and others are raising new concerns through the RFI process and subsequent planning processes). The agencies should capitalize on near-term opportunities to make improvements to the WWEC through ongoing land-use-planning efforts while also pursuing the funding and spending the time and resources to implement the longer-term efforts required by the Settlement Agreement (**Attachment 1**). Finally, the Agencies should ensure that relevant NEPA documents for new transmission lines and corridors include appropriate WWEC as alternatives and focus development within appropriate WWEC wherever possible, consistent with BLM's recent guidance on use of the WWEC, Instruction Memorandum 2014-080.[3]

2. Identification of Priority Regions

We understand that the Agencies will be identifying one or more priority regions for the first WWEC re-evaluation effort which is currently underway. We recommend that western Arizona, southern Nevada, and the California Desert be included as a priority region because these lands are home to important unfragmented wild lands and critical wildlife habitat that should be protected and it is also a crucial region for renewable energy and transmission development and upgrades. The Intergovernmental Panel on Climate Change (IPCC) also ranks the Mojave Desert region as an area that may be particularly impacted by climate change and therefore immediate planning to ensure that species, species pathways and habitat in the Mojave Desert are protected from adverse impacts of energy and related transmission is imperative.[4]

California is the largest market for renewable energy in the nation, and California, Nevada and Arizona all have excellent renewable energy resources that developers are working to access and deliver to markets. The number of applications for renewable energy generation and transmission projects in this region dwarfs the rest of the west, also highlighting the importance of focusing on this region first. Focusing on this region can also provide immediate benefits by taking advantage of the opportunity to integrate with ongoing planning processes in the region, detailed below.

In addition to National Environmental Protection Act (NEPA) and associated state-level (e.g., California Environmental Quality Act) analysis for proposed transmission and renewable energy generation projects, there are also a number of ongoing state and BLM planning efforts underway in this region that provide opportunities to make improvements to the WWEC in the near-term. These include the Las Vegas Resource Management Plan revision, the Desert Renewable Energy Conservation Plan (DRECP) in California, development of Regional Mitigation Strategies for Solar Energy Zones (SEZ) in Nevada and Arizona, travel management plans in California's West Mojave subregion and BLM's work to develop a monitoring and adaptive management plan for the Riverside East SEZ in California. We call particular attention to the DRECP, which is proposed to cover 22.5 million acres of the California desert; we strongly recommend that WWEC regional planning needs to sync with the DRECP as soon as is practicable.

Recommendation: The agencies should include western Arizona, southern Nevada and the California Desert as a priority region as part of the WWEC re-evaluation because the region's abundant important wild lands and wildlife habitat require protection, there is strong pressure for

[3] Available at: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2014/IM_2014-080.html
[4] See, e.g., www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%203.pdf

additional renewable energy and transmission development in the region, and there are numerous opportunities to make improvements to the WWEC in the near-term through ongoing land-use planning and NEPA analysis and associated Resource Management Plan amendments for proposed projects.

3. Assessment of Existing and Potential Future WWEC

a. Justification for WWEC including how they may facilitate renewable energy development

The WWEC re-evaluation is designed to ensure that WWEC designations "provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission." (Settlement Agreement p. 6 (**Attachment 1**))

Given the technological, market, and policy changes that have occurred in the energy sector since the existing WWEC were designated, it is unclear whether any of these WWEC meet this important criteria. New analyses, reports, and plans have been developed that seek to determine where there may be a need for additional transmission capacity to facilitate renewable energy development. These sources of information should be reviewed by the Agencies while reviewing existing WWEC and considering potential new WWEC.

Moreover, ongoing developments underscore that the electric energy industry is in a great deal of flux. These developments include:

- **Retirement of coal plants.** Due to evolving federal regulations concerning federal pollution and health standards, as well as economic reasons, there is a trend toward the planned retirement or closure of coal plants. It is estimated this will open up approximately 4,000 MW of new capacity between Utah and Arizona and California. Development of new generation sources will be required to meet consumer usage demands and this may affect operation of the current transmission system, including by providing opportunities to re-purpose existing transmission lines that are currently transmitting electricity from coal-fired power plants to transmit electricity from new renewable energy generation projects.

- **Expanding use of natural gas**. Recent technology changes have increased the amount of natural gas available in this country resulting in some utilities expanding their planned use of natural gas for power generation. Note that some signatories to this letter do not endorse the increased use of natural gas as an electricity source due to climate, lands, and wildlife concerns.

- **Expanded development of solar and other renewable energy sources.** Clean energy development is being driven by a number of factors: states have renewable energy procurement requirements (Arizona - 15% by 2025, California - 33% by 2020, Colorado - 30% by 2020, Nevada - 25% by 2025, and New Mexico - 20% by 2020); renewable energy costs have been decreasing significantly; utilities are planning for control of carbon dioxide pollution; utilities have been adopting and integrating renewables such as solar into their generation mix; and rooftop solar generation has been embraced by consumers and will help to moderate peak demand.

- **Greater control of electrical usage.** Energy efficiency, demand response, smart meter and advanced control systems, often referred to as smart grid initiatives, allow individuals and utilities to shape their load and demand. With increased penetration of renewables, these initiatives will become increasingly important to assure reliability.

- **Growing use of electric and plug-in hybrid electric vehicles.** Electrification of the transportation sector creates a new load source that will likely impact electricity resources through increased demand and possible shifts in demand cycles, as well as possible storage capacity.

- **Increased use of distributed generation.** Micro grids, residential and commercial photovoltaic systems, and on-site generation technology requires investment in distribution infrastructure. Electric vehicles or plug-in hybrids may also provide a source of storage, akin to distributed generation, if used to feed electricity back into the grid during peak demand hours.

- **More frequent and extensive cooperation among electric entities in the West.** Among utilities, the changing generation mix has created interest in sharing reserves and energy imbalances to smooth variability of renewable energy generation. This will likely require that utilities build new systems to share resources to better plan and more easily cooperate across service areas and state lines.

- **Forecasting beyond traditional utility transmission plans**. Under existing business models, electric utilities in the West have a specific geographic region (their "service area") for which they are required to provide electricity for all customers. As part of serving their customers, utilities are responsible for building the infrastructure (including transmission) necessary to bring power to customers. Typically, utilities use 10-year planning horizons to determine future infrastructure needs within their service areas. While both the scale and timeframe used by utilities to plan for transmission have been sufficient to forecast utility customer demands and the need for individual transmission lines, the planning processes provide little information on the need for future energy corridors that may benefit one or more utilities or customers beyond their respective service areas.

- **The emergence of merchant/independent transmission developers.** New federal regulations[5] also allow private (merchant and independent) transmission developers, who do not have a specific customer base, to compete to build transmission. A merchant/independent transmission developer's job is to build transmission to an economically justifiable location that may serve a number of energy developers and providers, including utilities. The merchant/independent developer approach introduces a further element of uncertainty about how future transmission will be developed and location of possible lines.

[5] Federal Energy Regulatory Commission Order 1000.

While some trends may indicate a reduced need for transmission corridors, other trends point to the increased importance of a strong transmission system. No matter which trend prevails, there will be changes to the use of the existing transmission system. Conflicting trends also strongly illustrate the uncertainty of future sources of electricity, usage demands, grid reliability, and the need to preserve options for appropriately-sited new transmission development, as increased development of appropriately-sited renewable energy resources may require additional transmission development. Options for supporting increased renewable energy development that do not require new transmission development should be pursued whenever possible. These options include but are not limited to local and distributed generation, re-purposing existing transmission lines that are getting freed-up capacity as existing coal-fired power plants are retired to transmit electricity from renewable energy generation projects, and upgrading existing transmission lines.

Given the uncertainties in forecasting transmission needs, the agencies should clarify the key assumptions and justifications for existing WWEC and those that will drive future WWEC designations. As directed in the Settlement Agreement (**Attachment 1**), this includes how WWEC may facilitate appropriately-sited renewable energy development. The corridor siting principles detailed in the Settlement Agreement dictate that the Agencies will consider how "Corridors provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission." (Settlement Agreement p. 6) These assumptions and justifications are particularly important for "Corridors of Concern" identified in the Settlement Agreement as potentially facilitating additional coal-fired electricity production, but they should be developed for all WWEC.[6] This may be accomplished through preparation of various development scenarios and determining commonalities within these scenarios such as presumed development zones that serve as overall driving assumptions behind corridor designations. This is essentially the approach taken by the Western Electricity Coordinating Council (WECC) in development of their 10- and 20-year regional transmission plans. It is also the approach being taken by the BLM with the Western Solar Plan and the DRECP. Actions should also be consistent with the President's Climate Action Plan.[7]

Recommendation: The Agencies should develop a clear set of overarching assumptions and justifications for existing WWEC and those that will drive future WWEC designations, including how WWEC may or may not be needed to facilitate appropriately-sited renewable energy development, with a particular focus on "Corridors of Concern" identified as potentially facilitating additional coal-fired electricity production. The agencies should consider using a scenario planning process similar to the one developed by WECC or partner with WECC in subsequent updates to their regional transmission plans.

[6] "Corridors of Concern" were identified by the plaintiffs in *The Wilderness Society, et al. v. United States Department of the Interior, et al., No. 3:09-cv-03048-JW (N.D. Cal.)* as having specific environmental issues. As part of the Settlement Agreement, the BLM and the FS committed to re-evaluating the "Corridors of Concern" as part of the period review process. The list of "Corridors of Concern" and specific environmental issues was included in Exhibit A to the Settlement Agreement, attached to this letter as **Attachment 2**.
[7] Available at: http://www.permits.performance.gov/pm-implementation-plan-2014.pdf

b. Justification of individual WWEC designations

There is also a need for the Agencies to provide additional information regarding the assumptions and justification behind individual WWEC designations. Similarly, these should address how transmission development in individual corridors will facilitate responsible renewable energy development. For example, there have been numerous studies in Arizona that have assessed the need for additional transmission capacity, including biennial transmission assessments, some which discuss how to increase Arizona's export capability to markets in California.[8]

Additionally, the Agencies should consult more closely with utilities regarding their transmission planning priorities. Recent discussions with utilities underscore that current designated corridors are not perceived to meet their needs. Also, it should be noted that the two "merchant" lines in the Southwest undergoing environmental assessments under NEPA—SunZia and Southline—chose not to use WWECs as their preferred routes. As to what factors may be contributing to their lack of use, that will require additional analyses. These may include some of the trends described in section 3(a) of our comments.

Recommendation: The Agencies should develop a clear set of assumptions and justifications specific to each individual WWEC designation. These should be based in part on consultations with utilities, renewable energy developers, and merchant line developers, as well as other stakeholders involved in, but not limited to, the DRECP, the Arizona Restoration Design Energy Project and the California Independent System Operator (CAISO).

c. Recommended data sources to identify future transmission needs

A number of transmission and renewable energy planning and forecasting efforts have been conducted since the WWEC Record of Decision (ROD) was signed in January 2009. These data sources should be considered by the Agencies as they re-evaluate the existing WWEC and consider potential future WWEC.

- Solar Programmatic Environmental Impact Statement – The Solar PEIS was prepared by the U.S. Department of Energy, Energy Efficiency and Renewable Energy Program and the U.S. Department of the Interior, Bureau of Land Management in order to assess environmental impacts associated with the development and implementation of agency-specific programs that would facilitate environmentally responsible utility-scale solar energy development in six western states (Arizona, California, Colorado, New Mexico, Nevada, and Utah) http://solareis.anl.gov.

- Restoration Design Energy Project (RDEP) – RDEP is a BLM Arizona initiative to identify lands across the State that may be suitable for the development of renewable energy. It establishes 192,100 acres of renewable energy development areas on BLM land throughout Arizona. http://www.blm.gov/az/st/en/prog/energy/arra_solar.html.

[8] For example, see *Seventh Biennial Transmission Assessment (2012-2021 Staff Report*, Arizona Corporation Commission Docket No. E-00000D-11-0017, December 12, 2012.

- Regional Transmission Expansion Plan (RTEP) – The Western Electricity Coordinating Council (WECC creates biennial 10-year plans and a 20-year Interconnection-wide transmission plans that are guided by stakeholder-created scenarios and informed by environmental analysis. These plans are designed to inform a wide range of stakeholders on potential impacts to reliability and assist in meeting policy mandates. http://www.wecc.biz/committees/BOD/TEPPC/Pages/RTEP.aspx.

- Renewable Electricity Futures Study - The National Renewable Energy Laboratory's study is an initial investigation of the extent to which renewable energy supply can meet the electricity demands of the continental United States over the next several decades. This study explores the implications and challenges of very high renewable electricity generation levels—from 30% up to 90%, focusing on 80%, of all U.S. electricity generation—in 2050. http://www.nrel.gov/analysis/re_futures.

- Arizona Renewable Resource and Transmission Identification Subcommittee (ARRTIS) – This subcommittee to the Renewable Transmission Task Force of the Southwest Area Transmission Planning group, surveyed renewable resource and environmental sensitivity data to identify areas within the state where solar and wind resources were technically ideal for utility-scale generation development and the location of environmentally sensitivity areas, that should be excluded from consideration for generation facilities. http://www.westconnect.com/filestorage/ARRTIS%20Final%20Report.pdf.

- Desert Renewable Energy Conservation Plan (DRECP). The DRECP will cover 22.5 million acres of the California Desert and is being prepared by BLM, U.S. Fish and Wildlife Service, the California Energy Commission and California Department of Fish and Wildlife. This landscape level planning effort will allocate lands for appropriately-sited renewable energy development and conservation of key species and habitats over the next 30 years. The DRECP has developed a robust set of currently available data that should be incorporated into WWEC and future transmission planning. See http://drecp.databasin.org/; see also http://drecp.org/

- Environmental Data Task Force Risk Methodology: Western Electricity Coordinating Council's Environmental Data Task Force has been tasked with investigating and developing recommendations for methodologies to incorporate environmental and cultural data into the transmission planning process for the Western Interconnection. As a result, EDTF has developed a *Recommendations Report*[9] and a *Geospatial Data Viewer.*[10] These and other EDTF products are available for public use, facilitate knowledge transfer within planning organizations, and are in use within WECC and outside of WECC by industry, regulators, and other stakeholders.

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9 http://www.wecc.biz/committees/BOD/TEPPC/SPSG/EDTF/Shared%20Documents/Report%20to%20SPSG/Environmental%20Recommendations%20for%20Transmission%20Planning%20-%20Synopsis%20Revised%2005-27-2011.pdf This information has not previously been available in a single location and represents a significant step towards understanding potential environmental and cultural aspects of planning transmission in the Western Interconnection.

10 http://184.169.179.203/flexviewers/WECC2/

Recommendation: The Agencies should use the data sources above to help identify future transmission needs.

d. Recommended approach to environmental analysis of WWEC

As detailed in the Settlement Agreement, the Agencies are required to improve their approach to completing environmental analyses of the WWEC to better avoid environmentally sensitive areas. Arizona BLM used an innovative approach to screening potential wind and solar development lands in RDEP that should be used as a model for screening the WWEC. RDEP did not identify or designate priority "Renewable Energy Development Areas" in locations that conflicted with the screens. Though the RDEP screens were developed in consideration of wind and solar development, most of the screens are also appropriate in consideration of large-scale transmission development (100 kV or greater) contemplated for the WWEC. If WWEC conflict with the screens, the Agencies should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict. The screens used for RDEP are included as **Attachment 3**.

The landscape-scale assessment used in RDEP is consistent with several other BLM assessments and analyses including the Western Solar Program and BLM's Rapid Ecoregional Assessments. It is also consistent with BLM guidance directing a landscape-scale or regional approach to planning for and mitigating energy development in the agency's Draft Regional Mitigation Manual. Overall, a more comprehensive approach to planning for and mitigating renewable energy and transmission development is needed to limit and off-set impacts while supporting responsible development.

Beyond the landscape-scale assessment using the RDEP screens, the Agencies should also complete a more detailed analysis of the WWEC using site-specific data, including the data sources recommended in Section 3(f) of these comments.

Recommendations: The Agencies should use the RDEP screens to conduct a landscape-scale assessment of the WWEC. If WWEC conflict with the screens, the Agencies should address the conflict by: removing or adjusting the WWEC to avoid the conflict; establishing Interagency Operating Procedures to address the conflict; and/or recommending off-site, compensatory mitigation to address the conflict. The Agencies should also conduct more detailed analyses of the WWEC using site-specific data in consultation with federal and state wildlife and science agencies to interpret the best available information from BLM, state wildlife agencies, USGS models and other data sources identified below at 3(f).

e. Environmental assessment of non-federal lands WWEC may traverse

The Western Electricity Coordinating Council hosted three meetings with transmission developers in the fall of 2013 to solicit feedback on potential transmission corridors, including WWECs. Meeting participants reached no consensus regarding the WWEC, noting that these corridors "often end at high-risk lands – not continuous from federal to private lands, which diminishes their usefulness."[11] Participants also added that the WWEC "often still contain sensitive environmental and cultural resources that are identified at the siting level." While these comments elucidate the views of a small group of transmission developers, they likely underscore the need for the Agencies to engage transmission developers more effectively in the identification of potential WWEC and conduct more thorough environmental assessments of potential WWEC.

For existing WWEC to be truly functional, there must be a reasonable basis to assume that all segments of the WWEC, including portions not on federal lands, avoid environmentally sensitive areas to the maximum extent practicable. While the Agencies do not have the authority to designate WWEC on non-federal lands, they do have the capacity to extend environmental assessments done on federal lands to non-federal lands. The RDEP planning process conducted by the Arizona BLM serves as an important precedent and example of how such an assessment can be extended to non-federal lands.

Recommendation: The Agencies should extend its environmental assessment of existing corridors to non-federal lands, including private and state trust lands.

f. Recommended additional data sources for environmental assessment of WWEC

In addition to the data sources included in the WWEC Programmatic Environmental Impact Statement, the Agencies should also use the following data sources as they conduct environmental assessments of potential new WWEC:

- Western Governors' Association Crucial Habitat Assessment Tool (CHAT): "CHAT, online at westgovchat.org, aims to bring greater certainty and predictability to planning efforts by establishing a common starting point for discussing the intersection of development and wildlife. CHAT's interface offers easily accessible online system of maps displaying crucial wildlife habitat and corridors across the West. While not intended for project-level approval, CHAT is designed to reduce conflicts and surprises while ensuring wildlife values are better incorporated into land use decision-making, as well as large-scale conservation projects." http://www.westgovchat.org/

- Revised and/or amended BLM Resource Management Plans (RMPs): BLM has recently revised or amended numerous RMPs across the west. Updated data and land management information from these RMPs should be evaluated.

- BLM-Inventoried Lands with Wilderness Characteristics and Citizen-Inventoried Lands with Wilderness Characteristics

BLM now has current guidance requiring updating its inventory of lands with wilderness characteristics and considering protection of those values. FLPMA requires the BLM to

[11] See summary of results p. 3, available at: http://www.wecc.biz/committees/BOD/TEPPC/EDTF%20Communications/131211_EDTF_Webinar_Summary.pdf

inventory and consider lands with wilderness characteristics during the land use planning process. 43 U.S.C. § 1711(a); s*ee also Ore. Natural Desert Ass'n v. BLM,* 625 F.3d 1092, 1122 (9th Cir. 2010). IM 2011-154 and Manuals 6310 and 6320 contain mandatory guidance on implementing that requirement. The IM directs BLM to "conduct and maintain inventories regarding the presence or absence of wilderness characteristics, and to consider identified lands with wilderness characteristics in land use plans and when analyzing projects under [NEPA]." Manual 6320 requires BLM to consider lands with wilderness characteristics in land use planning, both in evaluating the impacts of management alternatives on lands with wilderness characteristics and in evaluating alternatives that would protect those values.

While some of the affected field offices have updated inventories, received public comment, and considered management alternatives for lands with wilderness characteristics under the new guidance, many field offices have not completed this process and we are engaged in reviewing BLM's inventory information, conducting our own field inventories and commenting on completeness and accuracy of inventories as well as management alternatives. Accordingly, where field offices have not completed this process and incorporated decisions into finalized land use plans, BLM must complete inventories, assess new information and public input, and consider management alternatives prior to approving projects. At this point, we would recommend BLM incorporate updated information on potential lands with wilderness characteristics and use that as part of the corridor screening process, as well as committing to complete inventory and evaluation prior to approving projects. Where BLM or citizen inventories have found lands with wilderness characteristics, BLM should exclude WWEC from those areas and BLM should not approve projects in those areas. Further, BLM should designate these areas as ROW exclusion or avoidance areas.

The results of a GIS analysis of conflicts between these areas and WWEC is included as **Attachment 4**. The analysis was completed using four types of data:

BLM-identified potential Lands with Wilderness Characteristics: these are areas greater than 5,000 acres or that otherwise meet the size criterion per Manual 6310 that BLM has identified as potentially roadless through a desktop analysis. BLM is now inventorying these areas according to the guidance in IM 2011-154 and Manual 6310 to determine whether they have wilderness characteristics. As stated above, BLM must complete inventories, assess new information and public input, and consider management alternatives prior to approving projects. At this point, we would recommend BLM incorporate updated information on potential lands with wilderness characteristics and use that as part of the corridor screening process, as well as committing to complete inventory and evaluation prior to approving projects. If these areas are found to have wilderness characteristics, BLM should exclude WWEC from these areas and BLM should not approve projects in those areas; further, BLM should designate these areas as ROW exclusion or avoidance areas.

BLM-inventoried Lands with Wilderness Characteristics: these are areas that BLM has inventoried according to the guidance in IM 2011-154 and Manual 6310 and found to have wilderness characteristics. BLM should exclude WWEC from these areas and BLM should not approve projects in those areas. Further, BLM should designate these areas as ROW exclusion or avoidance areas.

Citizen-identified Potential Lands with Wilderness Characteristics: these are areas greater than 5,000 acres or that otherwise meet the size criterion per Manual 6310 that citizen groups have identified as potentially roadless through a desktop analysis and have recommended that BLM inventory for wilderness characteristics. As stated above, BLM must complete inventories, assess new information and public input, and consider management alternatives prior to approving projects. At this point, we would recommend BLM incorporate updated information on potential lands with wilderness characteristics and use that as part of the corridor screening process, as well as committing to complete inventory and evaluation prior to approving projects. If these areas are found to have wilderness characteristics, BLM should exclude WWEC from these areas and BLM should not approve projects in those areas; further, BLM should designate these areas as ROW exclusion or avoidance areas.

Citizen-inventoried Lands with Wilderness Characteristics: these are areas that Citizen groups have inventoried according to the guidance in IM 2011-154 and Manual 6310 and found to have wilderness characteristics. This information has been submitted to BLM and is being evaluated by the agency. BLM should exclude WWEC from these areas and BLM should not approve projects in those areas. Further, BLM should designate these areas as ROW exclusion or avoidance areas.

- Citizens' Wilderness Proposal areas: These lands have been inventoried by citizens groups, conservationists, and agencies and have been found to have "wilderness characteristics," including naturalness, solitude, and the opportunity for primitive recreation. These areas should be excluded from WWEC. A GIS analysis of conflicts between WWEC and Citizens' Wilderness Proposal areas is included as **Attachment 5**. Contact: Alex Daue, The Wilderness Society, alex_daue@tws.org, (303) 650-5818, ext.108.

- Forest Service Inventoried Roadless Areas and Citizens' Wilderness Proposal areas: these roadless areas should also be protected from development and WWEC should be excluded from them. A GIS analysis of conflicts between WWEC and Forest Service Inventoried Roadless Areas and Citizens' Wilderness Proposal Areas will be submitted under separate cover. Contact: Alex Daue, The Wilderness Society, alex_daue@tws.org, (303) 650-5818, ext.108.

- BLM Rapid Ecoregional Assessments: REAs compile and analyze existing scientific information to establish baseline conditions and assess changes over time. They represent a snapshot of current and predicted future conditions based both on available data as well as on models that leverage these data. Their purpose is to identify key resource conditions and trends within and across an ecoregion. REAs are not fully standardized in terms of methods across ecoregions and were completed by multiple outside contractors, making generalities about use of outputs from the various REAs difficult. In general, however, when defining relative conflicts of the WWECs, we recommend the Agencies consider all data layers from each REA's Data Catalog Appendix to determine which should be considered with a focus on those related to habitat intactness and habitat value (both current and predicted) for key species. In cases where a key species would lose current, high value habitat or habitat predicted to be important for future climate change resiliency, avoidance should be prioritized.

- Desert Renewable Energy Conservation Plan (DRECP). The DRECP will cover 22.5 million acres of the California Desert and is being prepared by BLM, U.S. Fish and Wildlife Service, the California Energy Commission and California Department of Fish and Wildlife. This landscape level planning effort will allocate lands for appropriately-sited renewable energy development and conservation of key species and habitats over the next 30 years. The DRECP has developed a robust set of currently available data that should be incorporated into WWEC and future transmission planning. See http://drecp.databasin.org/; see also http://drecp.org/

- BLM Greater Sage-Grouse RMP Amendments. We note that the WWECs not only have the potential to impact greater sage-grouse, but also other grouse species and populations such as Gunnison sage-grouse and the bi-state Distinct Population Segment of sage-grouse in California and Nevada. Particular care must be taken to avoid, minimize, and compensate for impacts to these small, isolated populations of grouse. BLM and the USFWS are in the process of developing conservation measures, including through land use plan amendments, to protect greater sage-grouse; and the USFWS has yet to make decisions regarding the listing of these species under the Endangered Species Act. The Agencies should incorporate the final results of these processes as they adjust and improve the WWEC. In the interim, the Agencies should follow the recommendations from the FWS' Conservation Objectives Team (COT) Report to avoid energy development in Priority Areas for Conservation (PACs) and the BLM National Technical Team (NTT) Report to "exclude energy development and other large-scale disturbances from priority habitats." The NTT report also recommended making priority sage-grouse habitats exclusion areas for new ROWs permits, with possible exceptions related to co-locating the new project footprint within an existing disturbance area. Finally, the NTT report recommended that the BLM "evaluate and take advantage of opportunities to remove, bury, or modify existing power lines within priority sage-grouse habitat areas."

- State Wildlife Action Plans: While the CHATs are based on spatial analysis conducted for the State Wildlife Action Plans, other aspects of the state plans related to management priorities may not have been included in the geospatial CHATs. We recommend that the agencies consult with the states on the use of their Wildlife Action Plans to inform corridor designation.

- ESA Recovery Areas: Under section 7(a)(1) of the ESA, BLM is explicitly obligated to utilize its existing authorities to affirmatively conserve ESA listed species. Section 7(a)(1) is designed to ensure that federal agencies "conserve" listed species, which means to improve the status of a species to the point where it no longer requires the ESA's protection. In order to fulfill obligations under section 7(a)(1), the agencies should consider and as best practicable avoid impacts to geographic areas for recovery units for threatened and endangered species. We recommend the agencies identify any recovery units for threatened and endangered species and avoid impacting them to an extent that impedes recovery progress.

- California Desert Conservation Area designations: In addition to BLM ACECs, the BLM in California has designated Wildlife Habitat Management Areas (WHMAs) and Unusual Plant Assemblages (UPAs) in the California Desert Conservation Area (CDCA). Likewise, California Native Plant Society (CNPS) has designated all species in CNPS Category 1B as Sensitive Species. We recommend that the Corridor Study include datasets on California Native Plant Society Category 1B Sensitive Species, WHMAs and UPAs, especially those UPAs that are classified as Sensitive and Highly Sensitive.

- Permeability and connectivity: We recommend the agencies include datasets that map and model landscape permeability[12] and connectivity. Specifically, we recommend using two developed by Theobald et. al.[13] to examine Landscape Permeability and Flowlines of connectivity across the landscape. Long-term conservation for wildlife will depend on maintaining connectivity across a diversity of ecosystems. Maintaining landscape permeability and connectivity is essential for individual and population-level persistence for many species. Disruption of movement patterns by development can alter ecosystem functions and isolate habitats. For these reasons, maintaining the connectivity and permeability of the landscape is essential to prevent species and their habitats from becoming imperiled. While states were directed to include a Connectivity or Linkage assessment in developing their CHATs, linkages developed at the state scale may not be applicable at the broader, landscape-scale west-wide. We recommend the agencies consult closely with Western states to review any other state-level detailed corridor assessments and include those datasets in the Corridor Study.

  In California, we recommend the agencies include state-wide and California desert-specific connectivity studies: The California Essential Habitat Connectivity Project[14] and A Linkage Network for the California Deserts.[15] The California Essential Habitat Connectivity Project, completed in 2010, aimed to identify large remaining blocks of intact habitat or natural landscape and model linkages between them that need to be maintained, particularly as corridors for wildlife. The California Desert Linkage Network, conducted by SC Wildlands, identified areas where maintaining or restoring ecological connectivity is essential to conserving California desert's biodiversity.

- Landscape Conservation Cooperatives (LCCs)[16]: LCCs "provide a forum for States, Tribes, Federal agencies, non-governmental organizations, universities and other groups to work together in a new way. LCCs are applied conservation science partnerships with two main functions. The first is to provide the science and technical expertise needed to

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[12] Landscape permeability is a measure of a species' ability to "percolate" across a connected landscape.
[13] Theobald, D. M., Reed, S. E., Fields, K. and Soulé, M. (2012), Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States. Conservation Letters, 5: 123–133. doi: 10.1111/j.1755-263X.2011.00218.x
[14] For more information, see California Department of Fish and Wildlife's Connectivity webpage at: http://www.dfg.ca.gov/habcon/connectivity/.
[15] The full report is available for download online at: http://www.scwildlands.org/reports/ALinkageNetworkForTheCaliforniaDeserts.pdf.
[16] http://www.fws.gov/landscape-conservation/lcc.html

support conservation planning at landscape scales – beyond the reach or resources of any one organization… The second function of LCCs is to promote collaboration among their members in defining shared conservation goals." (from LCC website)
- State and local wildlife resource agencies (e.g. California Department of Fish and Wildlife, Arizona Department of Game and Fish, etc.)
- Local universities and research facilities
- Peer-reviewed wildlife migratory corridor and wildlife movement data such as the work on the California desert conducted by SouthCoast Wildlands.
- Oregon Sage-Grouse Plans: Oregon Governor Kitzhaber has convened the Oregon SageCon working group to develop an all-lands, all-threats approach to sage-grouse management in Oregon. The State of Oregon is working closely with BLM and other stakeholders to develop management approaches consistent across different jurisdictions. WWEC corridors should be evaluated for consistency with the nearly complete State of Oregon sage-grouse plan.

Recommendation: the Agencies should use the data sources above in its re-evaluation efforts.

g. Engagement in other planning efforts

A number of transmission and other infrastructure planning efforts are ongoing or are commencing that offer opportunities to coordinate or integrate WWEC planning. Among them are (many of these are described above):

- BLM's California Desert Renewable Energy Conservation Plan (see description and link above)
- BLM Las Vegas RMP Revision
- BLM Greater Sage-Grouse RMP Amendments
- Moab Master Leasing Plan
- Other Master Leasing Plans
- BLM California's West Mojave Route Designation Process
- Oregon SageCon working group for the Oregon sage-grouse state plan

Recommendation: The Agencies should more proactively engage in these and other regional planning efforts to determine whether there are opportunities to coordinate or integrate WWEC planning.

h. Stakeholder engagement

With regard to stakeholder engagement, we offer the following considerations. First, planning for energy transmission corridors is both complex and will likely impact a broad range of landscapes, communities and counties in multiple ways. Conventional public engagement processes like those required under NEPA are intended to provide for meaningful public input but may not be adequate to address long-distance corridors that cross multiple jurisdictions and run through multiple communities. The Agencies should develop a robust outreach strategy that includes working with partners and parties to ensure stakeholders are aware of opportunities to engage and that they are being consulted on proposed actions, and additional engagement strategies should be considered by the Agencies. These include:

- Public meetings and workshops
- Public Mapping sessions that discuss resources and alternatives and their implications
- Listening sessions
- Webinars
- Circulation of preliminary alternatives for stakeholder feedback
- Comment periods in conjunction with regional media outreach informing the public of the comment periods
- Office hours hosted by BLM and USFS staff in affected regions
- Field trips
- Additional means to engage rural communities and counties as suggested by those stakeholders
- Solicit public comment with a court reporter present
- If available, pre-NEPA consultation processes such as those that the Rapid Response Transmission Team is pulling together under the direction of the President's Memorandum on transmission and recently released implementation memorandum.[17]

We recommend that the Agencies reach out to counties and communities affected by WWEC, particularly in those regions that either host "corridors of concern" and/or that may be subject to upcoming management plan revisions or regional planning for energy development and transmission. The agencies should solicit additional ideas from stakeholders in affected regions and tailor public outreach to best fit the needs of individual counties and communities.

Recommendation: The Agencies should more proactively engage state agencies, local governments and communities, NGOs and other stakeholders. Both agencies also should consider engagement strategies that go beyond those required under NEPA and that provide multiple stakeholders with additional opportunities for input. These complementary strategies could be led by or co-hosted with counties, non-governmental organizations or other entities.

4. Improvements to Interagency Operating Procedures

As part of the Settlement Agreement, the Agencies also committed to review their existing Interagency Operating Procedures (IOPs), including their effectiveness, pertinent new data, and suggestions from stakeholders for changes to the IOPs. IOPs identify required management procedures that would be incorporated into project-specific energy transport development proposals. The IOPs were incorporated into the land use plan amendments conducted as part of the WWEC PEIS ROD. The Agencies also committed to considering new IOPs for specific resources including, but not limited to, wildlife, wilderness characteristics and special areas.

The Solar PEIS included "Design Features" that were intended to achieve the same outcomes as the IOPs – avoiding, minimizing, and/or mitigating or off-setting the potential adverse effects of solar energy development. While the Design Features were developed to address solar energy

[17] Available at: http://www.permits.performance.gov/pm-implementation-plan-2014.pdf

development, most of them are applicable for transmission development in WWEC as well. The value of the Solar PEIS Design Features lies in their level of detail and specificity with regard to procedures and resources, the addition of which would greatly strengthen the WWEC IOPs. We recommend that the Agencies incorporate many of the Design Features from the Solar PEIS into the WWEC as IOPs and develop others specific to transmission. The Solar PEIS Design Features are on pp. 43-145 of the Solar PEIS Record of Decision.[18]

For example, the Solar PEIS Design Features for Specially Designated Areas and Lands with Wilderness Characteristics (two of the specific resources identified in the Settlement Agreement for consideration of improved IOPs) should be incorporated as IOPs ((Solar PEIS ROD pp. 54-56 – note that the lettering "A.4.1.2" comes directly from the Solar PEIS ROD and is not intended to follow the outline letter formatting of this comment letter):

> **A.4.1.2 Design Features for Specially Designated Areas and Lands with Wilderness Characteristics**
> The following design features have been identified to avoid, minimize, and/or mitigate potential impacts on specially designated areas and lands with wilderness characteristics from solar energy development identified and discussed in Sections 5.3.1 and 5.3.2 of the Draft and Final Solar PEIS.
>
> ***A.4.1.2.1 General***
>
> **LWC1-1** Protection of existing values of specially designated areas and lands with wilderness characteristics shall be evaluated during the environmental analysis for solar energy projects, and the results shall be incorporated into the project planning and design.
>
> (a) Assessing potential impacts on specially designated areas and lands with wilderness characteristics shall include, but is not limited to, the following:
>
> • Identifying specially designated areas and lands with wilderness characteristics in proximity to the proposed projects. In coordination with the BLM, developers shall consult existing land use plans and updated inventories.
> • Identifying lands that are within the geographic scope of a proposed solar project that have not been recently inventoried for wilderness characteristics or any lands that have been identified in a citizen's wilderness proposal in order to determine whether they possess wilderness characteristics. Developers shall consider including the wilderness characteristics evaluation as part of the processing of a solar energy ROW application for those lands without a recent wilderness characteristics inventory. All work must be completed in accordance with current BLM policies and procedures.
> • Evaluating impacts on specially designated areas and lands with wilderness characteristics as part of the environmental impact analysis for the project and considering options to avoid, minimize, and/or mitigate adverse impacts in coordination with the BLM.

[18] Available at: http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf

(b) Methods to mitigate unavoidable impacts on specially designated areas and lands with wilderness characteristics may include, but are not limited to, the following:

• Acquiring wilderness inholdings from willing sellers.
• Acquiring private lands from willing sellers adjacent to designated wilderness.
• Acquiring private lands from willing sellers within proposed wilderness or Wilderness Study Areas.
• Acquiring other lands containing important wilderness or related values, such as opportunities for solitude or a primitive, unconfined (type of) recreation.
• Restoring wilderness, for example, modifying routes or other structures that detract from wilderness character.
• Contributing mitigation monies to a "wilderness mitigation bank," if one exists, to fund activities such as the ones described above.
• Enacting management to protect lands with wilderness characteristics in the same field office or region that are not currently being managed to protect wilderness character. Areas that are to be managed to protect wilderness characteristics under this approach must be of sufficient size to be manageable, which could also include areas adjacent to current WSAs or adjacent to areas currently being managed to protect wilderness characteristics.

A A.4.1.2.2 Site Characterization, Siting and Design, Construction

LWC2-1 Solar facilities shall be sited, designed, and constructed to avoid, minimize, and/or mitigate impacts on the values of specially designated areas and lands with wilderness characteristics.[19]

Another example of Solar PEIS Design Features that should be included as IOPs are those for **Ecological Resources**, in particular for wildlife (which was also identified in the settlement agreement for consideration of improved IOPs) (Solar PEIS ROD pp74-89). While the section is too long to reproduce in its entirety here, we recommend that the Agencies incorporate its measures into the Corridor Review process. We note the value in particular of specific guidance on compliance with wildlife-related regulations in the early phases of project planning including:

- The Endangered Species Act,
- the Bald and Golden Eagle Act,
- the Migratory Bird Treaty Act,
- identification of sensitive ecological resources,
- considering restrictions on timing and duration of activities, etc.
- State specific ESA such as CESA

It is also particularly important to provide clear guidance on techniques for impact avoidance and minimization, including:

- limiting the number of stream crossings,
- conducting nesting bird surveys,

[19] See Section 4.3 of the Final Solar PEIS for details on areas included in these categories.

- siting and designing projects away from habitats occupied by Special Status Species,[20]
- placing tall structures to avoid known flight paths of birds and bats,
- implementing guidelines to minimize raptor and bird collision and electrocution hazard,
- marking transmission lines,
- designing line support structures and other facilities to discourage perching and nesting,
- spanning important or sensitive habitats with long lines,
- and other key design, construction, operations, and decommissioning techniques.

In addition to general Design Features applicable to all utility-scale solar development on BLM lands, the Solar PEIS also designated Design Features specific to each of the Solar Energy Zones designated through the Solar PEIS. The Agencies should also create specific IOPs for individual WWEC or segments of WWEC that are most likely to be developed to address specific resource issues there.

Recommendation: The Agencies should incorporate the Design Features from the Solar PEIS as IOPs, including the Design Features for Specially Designated Areas and Lands with Wilderness Characteristics and Ecological Resources. The Agencies should also create specific IOPs for individual WWEC or segments of WWEC that are most likely to be developed to address specific resource issues there.

5. Recommended changes to key WWEC to protect natural resources and access renewable energy

We have submitted detailed justification for our recommendations that WWEC in inappropriate locations be eliminated in our comments on the WWEC Draft PEIS. Those comments are incorporated by reference. Additional detailed input will also be provided going forward.

a. **Arizona** – note that Corridors of Concern are numbered in red. See **Attachments 4, and 5** for additional details on impacts to Citizens' Proposed Wilderness and Lands with Wilderness Characteristics.

[20] As described in the Solar PEIS ROD (p74), "Special status species include the following types of species: (1) species listed as threatened or endangered under the ESA; (2) species that are proposed for listing, under review, or candidates for listing under the ESA; (3) species that are listed as threatened or endangered by the state or are identified as fully protected by the state; (4) species that are listed by the BLM as sensitive; and (5) species that have been ranked S1 or S2 by the state or as species of concern by the state or USFWS. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840. These species are included here to ensure broad consideration of species that may be most vulnerable to impacts."

Corridor # and description	Issues identified in Settlement Agreement	BLM and FS Planning	Comments/Initial Recommendations
62-211: runs northeast from Phoenix area through the Tonto and Sitgreaves NFs. Locally designated. Follows existing 345 kV line to four corners area.	Access to coal, impacts to citizen-proposed and designated Wilderness, National Historic Place, Wild & Scenic Rivers, Mexican spotted owl critical habitat.	No ongoing BLM planning. The Tonto National Forest has begun scoping for revision of its land and resource management plan (see http://www.tontoplan.org/); they will be analyzing Potential Wilderness Areas, which would be expected to include a number of areas in the vicinity of 62-211	Environment (in addition to issues identified in Settlement Agreement): Intersects the Hellsgate Additions and two units of the Mazatzal Additions Citizens' Proposed Wilderness (CPW) areas. The existing wilderness areas north and south of route 62-11 (Four Peaks, Superstitions, Mazatzal) have high value as popular recreation areas used as an wilderness escape for the burgeoning Phoenix metro region – therefore the highest and best use of lands in this region includes preservation in a natural state. Intersects Mexican spotted owl habitat, and is one of the highest-risk (ranked third of all WWECs) to wildlife identified by Defenders of Wildlife, with Very High risk to CHAT resources and High risk to imperiled species and modeled connectivity flowlines across the landscape.[21] Access to fossil fuels and renewables: the existing 345 kV line likely serves the coal-fired power plants in the four corners area. It is very unlikely that new coal-fired generators will be built there. Some units of existing generators are being shut down as California moves away from coal. It is an open question whether that generation capacity will be replaced with natural gas or renewables, though gas may be more likely. **Initial recommendation:** Focus on opportunity to replace coal with renewables using capacity that could be freed up on the existing 345 kV line, and re-route the WWEC to avoid impacts or designate it as upgrade-only. Consider visual impacts to nearby CWP, Wilderness and IRA.

[21] Defenders of Wildlife conducted a geospatial risk analysis of the WWECs and submitted the analysis as an attachment to their comments on the RFI. In addition to using best-available data on several key species in particular regions (eg sage-grouse and desert tortoise), Defenders chose to conduct a coarse-scale, west-wide GIS-based risk analysis using comprehensive datasets on landscape permeability and "flowlines" of connectivity across the landscape (Theobald et al 2012), west-wide Crucial Habitat Assessment Tool data (Western Governors' Association and states), and imperiled species (NatureServe 2011 counts of G-1 and G-2 occurrences by HUC-12 watershed, and FWS designated critical habitat). Input from Defenders' analysis is included in several places in the Arizona and Oregon sections of these comments.

			Consider mitigation for NHP. Consult closely with state fish & game agencies and WGA to implement the full mitigation hierarchy of avoidance, minimization, and compensation for CHAT resources at Very High risk. Consult with FWS to avoid adverse modification to Mexican Spotted Owl critical habitat.
68-116: runs east west in Arizona Strip on border with Utah. Follows existing 500 kV line. Locally designated in Arizona except for small portion in Glen Canyon NRA near Page.	Access to coal, impacts to Grand Staircase-Escalante National Monument, Wild & Scenic Rivers, scenic byway.	No ongoing BLM or FS planning in Arizona.	Environment (in addition to issues identified in Settlement Agreement): Corridor crosses south end of Glen Canyon National Recreation Area. Scored Very High risk to modeled connectivity flowlines across the landscape by Defenders of Wildlife. Access to fossil fuels and renewables: unsure. **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider in context of continuation of this corridor and 116-206 in Utah and impacts to Grand Staircase Escalante Naitonal Monumnet. Consider adjusting corridor to eliminate crossing of NPS land in Glen Canyon National Recreation Area. Re-route to avoid Very High risk to the number and magnitude of flowline crossings, and where flowlines must unavoidably be crossed, minimize impacts to connectivity.
46-269: runs northwest from NW Phoenix, roughly paralleling Hwy 93. Intersects corridor 46-270 coming in from the east and then continues on as 41-46 to Bullhead City. Locally designated. Underground-only in region of 46-270 intersection.	Proposed and designated Wilderness areas, Wild and Scenic Rivers, Three Rivers Area of Critical Environmental Concern.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): Intersects the edge of several CPW units, including Black Butte East, Black Butte West, Harcuvar Mountains Additions, East Belmont Mountains, West Belmont Mountains, Harquahala Addition, the proposed Harquahala National Conservation Area and two units of the Swansea Additions. Intersects Three Rivers, Harquahala and Black Butte ACECs. Scored Very High risk to connectivity flowlines across the landscape and High risk to landscape permeability by Defenders of Wildlife, and intersects Sonoran Desert Tortoise category I or II habitat. 200m from Southwestern willow flycatcher critical habitat. Renewable energy potential: could be a pathway to Vegas or California, but not identified as a

			priority by Arizona utilities or solar developers. **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider removal if found unsuitable. Re-route to avoid CWPs and ACECs. Consult closely with FWS to avoid adverse modification to critical habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.
46-270: runs east-west east of Lake Havasu City. Intersects 46-269 where it becomes 41-46. Locally designated.	Wild & Scenic river, Southwestern willow flycatcher critical habitat.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): Intersects several CPW units, including two units of Lower Burro, Southwestern willow flycatcher critical habitat appears to be along creeks and rivers in the region. Intersects Burro Creek, Three Rivers, and McCracken ACECs. Scored Very High risk to connectivity flowlines across the landscape and High risk to landscape permeability by Defenders of Wildlife, and intersects Sonoran Desert Tortoise category I or II habitat. Renewable energy potential: could be a pathway to connect with 41-46 to get to Las Vegas or California, but not identified as a priority by Arizona utilities or solar developers. **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider removal of corridor if found unsuitable. Require IOPs (in consultation with FWS) to avoid adverse modification to Southwestern willow flycatcher critical habitat and ACECs. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and

			compensate for impacts within four miles of Cat I & II habitat.
41-46: runs northwest from intersection of 46-270 and 46-269 to intersection with 41-47 at Nevada border at Bullhead City. Locally designated except for a section south of I-40. Underground only at a small section just south of I-40 (just north of the non-locally designated section).	Impacts to Black Mountain population for desert tortoises.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): limited data available on distribution of Black Mountain population for tortoises. Possible listing as a distinct population. Intersects Bullhead Bajada Natural and Cultural ACEC. Intersects Sonoran Desert Tortoise category I or II habitat. Renewable energy potential: could be a pathway to get to Las Vegas or California, but not identified as a priority by utilities or solar developers. **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider removal of corridor if found unsuitable. Require IOPs to address ACEC and desert tortoise habitat. Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.

41-47: runs east-west from Kingman to Bullhead City on Nevada border. Could connect across non-federal lands to 41-46 and/or 27-41 (in California). Locally designated.	Impacts to Black Mountain population for desert tortoise.	No ongoing BLM or FS planning.	Environment(in addition to issues identified in Settlement Agreement): limited data available on distribution of Black Mountain population for tortoises. Possible listing as a distinct population. Intersects Black Mountains ACEC. Intersects Sonoran Desert Tortoise category I or II habitat. Renewable energy potential: could be a pathway to get to Las Vegas or California, but not identified as a priority by Arizona utilities or solar developers. **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider removal of corridor if found unsuitable. Require IOPs to address ACEC and desert tortoise habitat (in consultation with FWS). Minimize impacts from new energy infrastructure development to the maximum extent practicable, and where impacts are unavoidable, utilize compensatory mitigation pursuant to BLM policy. Use full mitigation hierarchy to avoid, minimize, and compensate for impacts within four miles of Cat I & II habitat.
47-231: runs east-west from the Hualapai Reservation 30 miles north of Kingman through the Lake Mead NRA and into Nevada. Appears to follow existing 500 kV line. Locally designated. Electric-only east of Lake Mead NRA.	Desert tortoise and bonytail critical habitat, Area of Critical Environmental Concern, Lake Mead National Recreation Area.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): Intersects desert tortoise, razorback sucker, and bonytail chub critical habitat. Also intersects desert tortoise conservation areas and FWS identified Priority 1 and 2 connectivity habitat. Intersects Black Mountains ACEC. Crosses Lake Mead NRA along existing 500 kV line. Renewable energy potential: could be a pathway to get to Las Vegas or California, but not identified as a priority by Arizona utilities or solar developers. In vicinity of the approved 500 MW Mohave Wind Project (which plans to use capacity on existing transmission lines) **Initial recommendation:** Carefully evaluate the suitability of the corridor with regards to the potential conflicts described above, and consider removal of corridor if found unsuitable. Require IOPs (in consultation with FWS) to address

			critical habitat, desert tortoise habitat, ACEC and Lake Mead NRA.
30-52: runs east-west along I-10 from Phoenix into California. An existing 500 kV line parallels I-10 but not right along the highway, ~5 to 20 miles north and south. Locally designated.	Not identified as a Corridor of Concern in the Settlement Agreement.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): ongoing evaluation, including intersection with desert tortoise, razorback sucker, Coachella Valley fringe-toed lizard, and Coachella Valley milk-vetch critical habitat. Also intersects Sonoran Desert Tortoise category I and II management habitat. See comments submitted on the WWEC RFI by the Arizona Solar Working Group on May 27th, 2014. Renewable energy potential: could be a good pathway to California markets, if a routing solution is found away from the San Gorgonio Pass or if a technological solution is found to place additional transmission infrastructure through the San Gorgonio Pass, which is currently a transmission bottleneck on the California side of 30-52. The Town of Gila Bend is including this corridor in its study of potential renewable energy transmission corridors in the region. **Initial recommendation:** recommend BLM drill down on this corridor to further assess potential issues, address routing concerns, and identify avoidance, minimization, and mitigation opportunities to make it a functional corridor. Coordinate with California stakeholders.

115-238: runs southwest from southwest Phoenix past Gila Bend, paralleling I-8 ~5 miles to the north. Follows existing 500 kV line. Heads into California and continues past El Centro almost to San Diego. Locally designated.	Not identified as a Corridor of Concern in the Settlement Agreement.	No ongoing BLM or FS planning.	Environment (in addition to issues identified in Settlement Agreement): ongoing evaluation. Renewable energy potential: could be a good pathway to California markets. The Town of Gila Bend is including this corridor in its study of potential renewable energy transmission corridors in the region. **Initial recommendation:** recommend BLM drill down on this corridor to further assess potential issues, address routing concerns, and identify avoidance, minimization, and mitigation opportunities to make it a functional corridor. Coordinate with California stakeholders.

b. California

California, probably more than any other state, has borne the brunt of new large-scale renewable energy development, particularly in the desert region. The state's ambitious renewable portfolio requirement of 33% electricity from renewable sources by 2020 means there will continue to be demand for energy produced both within the state and from out-of-state to service the greater southern California market, and that some of this energy will come from large-scale projects where long-distance transmission is needed. While some additional transmission will likely be needed to access anticipated developments and development focus areas (DFAs) designated via the DRECP, we want to ensure that new transmission corridors and new lines within existing corridors including the WWEC minimize adverse environmental impacts.

Additionally, the retirement of coal fired generation plans in Nevada, Arizona and Utah should free up thousands of megawatts of transmission capacity to export renewable energy into southern California.[22] Long-distance lines should also be sited within existing WWEC wherever possible to reduce the need for new WWEC. California will need to develop in-state transmission capacity to transmit renewable energy from areas such as Westlands Water District in the Central Valley (which has suitable degraded lands with 5,000 megawatts of potential generation capacity but is currently transmission-constrained). Using pre-existing transmission lines and corridors is environmentally and economically preferable to creating new WWECs in California.

In addition to the recommendations contained in the rest of these comments, in the California desert we highlight the need for the impacts of transmission corridors on wildlife habitat and

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[22] For example, see: http://www.renewableenergyworld.com/rea/news/article/2013/03/ladwp-to-eliminate-coal-fired-power-from-energy-mix-by-2025

migrations to be addressed in future planning efforts. For example, there are known, high priority movement corridors for both Desert tortoise and bighorn sheep along both the Interstate 15 and Interstate 40 corridors. Planning efforts should reflect existing Interior Department priorities to protect and connect these important populations. Transmission corridors such as corridor 27-225 along Interstate 15 pose barriers to effective wildlife movements and gene flow, in addition to resulting in increased animal kills. With corridor 27-225 identified as a WWEC, these problems will only increase as new transmission lines or gas pipelines are constructed. Further regional energy corridor planning in the California desert must address critical wildlife movement corridors such as those that cross Interstate 15 and Interstate 40, and needs to specify mitigation measures such as bridge crossings for bighorn sheep in these and other locations. Critical crossings have been identified along these areas, and further degradation of these areas should be avoided.

We have already noted (see section 3(f) above) the need to incorporate new data made available via the DRECP's Databasin website in future WWEC analyses. Due to the ongoing DRECP process and the potential impact of designation of development focus areas on transmission planning (and vice versa), we also request that a "listening session" be held in the California desert sometime this summer or early fall to educate stakeholders about the WWEC process and how it will tie in with the DRECP and other desert planning efforts.

Corridor 18-23 through the Owen's Valley

Corridor 18-23 traverses in a north-south direction through northern Mono County and the Owens Valley in Inyo County, and thence into Kern County. We objected to this corridor being designated as this region contains numerous sensitive resources; as a result of our concerns this corridor was identified as a "Corridor of Concern" in Exhibit A to the Settlement Agreement (**Attachment 2**). We strongly urge that this corridor be removed through the appropriate planning processes.

Resources of concern in the "Owens Valley corridor of concern" include:

- Land the corridor traverses, particularly in Mono County, contains habitat for the Bi-State Distinct Population Segment (DPS) of Greater sage-grouse. This DPS is being proposed for listing as Threatened under the federal Endangered Species Act, with a listing decision due by April, 2015. Mono and Inyo counties, along with other counties that are host to this unique and threatened bird, are working hard to avert a listing. We are deeply concerned about the potential impacts of development of new transmission lines, gas pipelines and associated projects in this region on the Bi-State sage grouse;
- The corridor bisects several BLM Wilderness Study Areas on the Volcanic Tablelands that contain sensitive archaeological and natural resources, and is near the Fish Slough Area of Critical Environmental Concern (ACEC) which is of particular importance to resident and migratory birds;
- The corridor passes through the Owens Valley, a highly scenic area of national significance. The Owens Valley and Owens River contain habitat for a range of sensitive, threatened, endangered and endemic species, including many avian species.

- The corridor traverses the Jawbone-Butterbrecht Area of Critical Environmental Concern (ACEC) in Kern County; this area is managed to protect wildlife habitat and Native American values as well as to provide for off-highway recreation.
- The Eastern Sierra region which corridor 18-23 traverses is a national and international tourist destination that provides abundant wild land and non-wild land based recreational opportunities to hundreds of thousands of visitors annually. There is substantial concern about the impact not only of new powerlines in this scenic wonderland but also that prioritizing this corridor via the Section 368 process would facilitate development of inappropriately-sited renewable energy facilities in the greater Eastern Sierra region.

While this corridor already exists and hosts the Pacific DC intertie in Mono County and several additional transmission lines in Inyo County, it is the possibility of new powerlines and of new energy development that is of concern. **Therefore we continue to strongly urge that this corridor be removed as a section 368 priority corridor.**

We request that the Agencies attend meetings of the Mono and Inyo County Boards of Supervisors this summer to present a primer on the WWEC process. Because a "corridor of concern" passes through these counties (corridor 18-23) it's important that these two counties and public stakeholders understand the ramifications of the WWEC designation and what it means for their counties, as well as ways to engage in the planning process for this corridor.

Corridor 27-41 along Route 66.

There is a WWEC (27-41) adjacent to Rt. 66 in the Mojave Desert. Due to the important historical, cultural and natural values in this region we believe this corridor needs to be eliminated and another east-west alternative selected, if feasible.

Efforts to preserve and enhance historic Rt. 66 in the Mojave Desert have been ongoing for decades. Currently, BLM is working with the California Historic Rt. 66 Association and local communities to prepare a Rt. 66 corridor management plan. The management plan will:

> "provide for the long-term management, protection and promotion of Route 66, and the preservation and conservation of the adjacent BLM National Conservation Lands/public lands. The Plan also will include a comprehensive interpretive, tourism and marketing strategy to promote sustainable heritage tourism in an effort to provide economic benefits to communities and local businesses."[23]

Most recently, the BLM Needles Field Office approved the development of a Rt. 66 Visitor Center.

Senator Dianne Feinstein (D-CA) has also proposed the Mojave Trails National Monument in this region, encompassing 941,000 acres of public lands along Rt. 66 and the adjacent viewshed. The efforts of the BLM, local communities and Senator Feinstein to provide permanent protection for Rt. 66 and adjacent lands, and to promote the region for heritage tourism and

[23] Available at: http://www.blm.gov/ca/st/en/fo/needles/route_66/route66cmp.html

provide an economic boost to communities along Rt. 66, are completely incompatible with WWEC 27-41, which traverses a significant portion of Rt. 66

Our organizations are also concerned about the alignment of WWEC 27-41 in the Mojave Desert region that makes an abrupt northward turn from its east-west trajectory near Rt. 66 (east of Essex), jogs along the southeastern border of the Mojave National Preserve and then turns eastward into Nevada. The entire line along the Preserve boundary and the eastward segment is in designated critical habitat for the Desert tortoise (the Piute-Fenner Critical Habitat Unit and the corresponding BLM ACEC for tortoise conservation). It would be best to have this proposed corridor alignment removed, and especially the segment to the east that appears to cut across the Piute Valley, an area known for high density of Desert tortoise.

We recognize the need to transmit renewable energy to the southern California market; however, we believe an alternative east-west corridor alignment would be preferable to the one chosen via the WWEC process. We suggest that the agencies modify the WWEC maps to eliminate the current Rt. 66 alignment and replace it with the east-west alignment of the existing corridor in the land use plan to the north that largely parallels Interstate 40 (see map included as **Attachment 6**). While we also have concerns about this alignment we believe it is preferable to the existing Rt. 66 corridor, as it avoids much of Rt. 66 (except for the section between Newberry Springs and Ludlow) and the important Desert tortoise habitat east of the Mojave Preserve.

<u>Other WWEC COCs in CA</u>
18-23: Areas of Critical Environmental Concern, Inventoried Roadless Areas, BLM Wilderness Study Areas, CA Boxer Wilderness, CA-proposed Wilderness, NV-proposed Wilderness, sage-grouse habitat, redundant to 18-224.
23-106: National Conservation Area, Area of Critical Environmental Concern.
23-25: critical habitat, National Conservation Area, Area of Critical Environmental Concern.
264-265: critical habitat, National Conservation Area, citizen-proposed Wilderness, USFS Inventoried Roadless Area.
107-268: National Forest, citizen-proposed Wilderness.
101-263: critical habitat; WSR; CA-proposed Wilderness, citizen-proposed Wilderness, USFS Inventoried Roadless Area.

c. Colorado

130-274 and 130-274(E): access coal, directly or indirectly impacts Gunnison sage-grouse conservation areas, occupied Gunnison sage-grouse habitat, CO-proposed Wilderness, USFS IRA.
87-277: coal, Wilderness, sage-grouse habitat; National Historic Places.
144-275: coal, wilderness, National Historic Places.

d. Idaho

24-228 (also in Oregon): sage-grouse habitat, pygmy rabbit habitat.

229-254 (also in Montana - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, "suitable" segment under Wild & Scenic Rivers Act.

e. Montana

229-254 (also in Idaho - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, "suitable" segment under Wild & Scenic Rivers Act, Continental Divide Trail, USFS Inventoried Roadless Area.

f. Nevada

17-35: access to coal plant, impacts to sage-grouse habitat.
16-24: Wilderness, National Conservation Area, National Historic Place, BLM Wilderness Study Area (in Oregon).
16-104: BLM Wilderness Area.
44-110: sage-grouse habitat.
110-233: sage-grouse habitat.
110-114: sage-grouse habitat, undisturbed, USFS Inventoried Roadless Area.
223-224: Areas of Critical Environmental Concern, Desert National Wildlife Refuge.
39-113, 39-231: Pahranagat National Wildlife Refuge, Rainbow Gardens ACEC, near proposed Gold Butte National Conservation Area, Black Mountain tortoise habitat.

g. New Mexico

81-272: Sevilleta National Wildlife Refuge, National Conservation Areas.

h. Oregon

7-24: Corridor 7-24 traverses large portions of southeastern Oregon in Malheur, Harney and Lake Counties. As proposed the corridor impacts sage-grouse habitat (including a 32% overlap with Priority Areas for Conservation (PACs)), pygmy rabbit habitat, the Steens Mountain Cooperative Management and Protection Area, the Steens Mountain geothermal withdrawal area and 3 citizen-proposed wilderness areas. Scored Very High risk to connectivity flowlines across the landscape in analysis by Defenders of Wildlife (see footnote 21 for description of analysis). Due to the significant amounts of priority and general sage-grouse habitat along the corridor as well as possible impacts to the Steens Mountain CMPA and other wilderness quality lands, this corridor – previously identified as a "corridor of concern" should be eliminated as a Section 368 priority corridor.

16-24: Corridor 16 -24 crosses large areas of priority (12% overlap with PACs across the 228 km-long corridor in Oregon and Nevada) and general sage-grouse habitat, pygmy rabbit habitat, BLM Lands with Wilderness Characteristics and 6 citizen-proposed wilderness areas. Scored Very High risk to connectivity flowlines across the landscape in analysis by Defenders of Wildlife. This corridor traverses a large area of priority sage-grouse habitat that provides critical habitat connectivity for sage-grouse populations in Malheur and Harney Counties. Due to the configuration of priority sage-grouse habitat in this region, acceptable modifications to reroute this corridor and avoid sage-grouse impacts would be unlikely.

24-228 (also in Idaho): Corridor 24-228 in Oregon passes through the BLM Alvord Desert Wilderness Study Area, areas of priority (58% overlap with PACs) and general sage-grouse habitat as well as a National Register of Historic Places property. Scored Very High risk to connectivity flowlines across the landscape in analysis by Defenders of Wildlife. This corridor should not be proposed inside the Alvord Desert WSA. Significant modifications would be necessary to avoid sage-grouse habitat. It is also important to note that corridor 24-228 may not be viable due to significant resource conflicts along corridors 7-24 and 16-24 to which 24-228 would connect.

230-248: critical habitat, National Register of Historic Places property, Pacific Crest Trail, Clackamas Wild & Scenic River and other "eligible" segments under Wild & Scenic Rivers Act, conflicts with Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves.

4-247: not close enough to QRA, old-growth forests, critical habitat, late-successional reserves, riparian reserves.

Additional details are included in the following attachments:

- **Attachment 7:** A map of wilderness places intersected by the SE Oregon WWEC
- **Attachment 8:** A zoomed in map of the Alvord Desert WSA area intersected by 24-228
- **Attachment 9:** A list of ONDA CWP units intersected by the SE Oregon WWEC
- **Attachment 10:** Excerpts of Oregon Natural Desert Association reports for Lakeview, Burns and Vale Districts for the units intersected by the SE Oregon WWEC
- **Attachment 11:** A map of sage-grouse habitat intersected by SE Oregon WWEC
- **Attachment 12:** A data table of WWEC overlap with wild places and sage-grouse habitat

i. Utah

110-114: much undisturbed, National Historic Place, BLM Wilderness Study Area, UT-proposed Wilderness.
66-259: access to coal plant, impacts to USFS Inventoried Roadless Area.
66-212: access to coal plant, impacts to National Historic Places, America's Byways, Old Spanish Trail, BLM Wilderness Study Area, UT-proposed Wilderness, critical habitat, adjacent to Arches National Park.
116-206: undisturbed, monument, Old Spanish Trail, UT-proposed Wilderness, near USFS Inventoried Roadless Area.
68-116, Grand Staircase National Monument, Paria River.
126-258: access to coal plant.

<u>National Parks</u>

For the most part, the proposed corridors avoid National Parks, although there is still room for improvement. One corridor of particular concern is segment 66-212. This corridor will clearly be within and dramatically impact the outstanding viewshed of the renowned Arches National Park (Arches) and over one million visitors from around the world who are drawn to the park each year. Currently, the viewshed from Arches National Park includes no developed areas or industrial sites (even the town of Moab is not in the Park's viewshed once visitors are approximately one-half mile from the visitor center). Although Appendix S lists sensitive visual resource areas that are intersected or in close proximity to designate corridors, there is no evaluation or even mention of the impacts to Arches' viewshed in the Final PEIS. Further, while the corridor narrows where it borders Arches National Park, the corridor is extremely wide (4-5 miles wide) south of Arches National Park and the town of Moab, intruding into WSAs and other Citizen Wilderness Proposal areas. As discussed above, the PEIS does not limit projects to designated corridors. As a result, the PEIS does not address how the narrower portion of segment 66-212 could accommodate the pipelines and powerlines that would be in the same corridors in adjoining areas and would connect through them. Instead, the PEIS makes it more likely that projects would be placed both in the narrowed portion of the corridor *and* outside it, increasing the improper impact on Arches and the surrounding lands.

In addition to affecting Arches National Park itself, this corridor crosses through spectacular, world-famous scenery. Much of the area has been proposed for wilderness preservation, including 1,000 foot high cliffs, slickrock domes, streams and floodplains, sensitive soils, and critical wildlife habitat. The corridor also crosses the Colorado River at the Portal near Moab. This Portal is a very narrow passage way carved by the river as it forced its way through the 1,000 foot tall, vertical Wingate and Navajo Sandstone cliffs.

The corridor has a mysterious gap as it reaches the town of Moab. Moab lies in a very narrow valley (approximately 1-2 miles wide) between steep sandstone walls. In order for projects within the corridor to go across the private property there will most likely either be a taking by the federal government in order to "connect the dots," or the corridor will necessarily have to be along the iconic Moab Rim on the west side of the valley or along the Mill Creek Rim along the east. Both of these rims are within BLM Wilderness Study Areas.

Corridor 66-212 can be easily re-routed to address most of the above concerns. Rather than continuing southeast from the town of Green River, the corridor should be directed east along the I-70 corridor to connect to the energy corridor in western Colorado (132-136). There is no compelling reason to have this proposed corridor impact sensitive natural resources, Arches National Park, the Colorado River, Citizen Wilderness Proposal areas, private property owners and the viewshed of Arches National Park and Moab when there is an alternative corridor in Colorado, slightly east of this proposed corridor, to which the Moab corridor would eventually merge.

Given that corridor 66-212 has been the subject of the most local and national concern for powerlines and pipelines, we also recommend that Agencies use the timely opportunity of the land use planning underway for the Moab Master Leasing Plan (which overlaps corridor 66-212) to eliminate the corridor.

Proposed corridor 68-116 passes through 20 miles of the Grand Staircase-Escalante National Monument in southern Utah. This 3,500-foot wide proposed corridor fails to follow existing road rights-of-way. The purpose and need of Corridor 68-116 should be re-evaluated and, at a minimum, the corridor should be re-routed to existing road rights-of-way to reduce conflicts with the natural and cultural resources of the National Monument.

j. Washington

102-105: numerous "suitable" segments under Wild & Scenic Rivers Act, borders designated Wilderness, Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves, crosses Pacific Crest Trail, tracks America's Byway within 1 mile, National Register of Historic Places property.
244-245: conflicts with Northwest Forest Plan, critical habitat, tracks America's Byway.

k. Wyoming

Any in core areas are prohibited for transmission use by BLM guidance.
78-255: sage-grouse core area and habitat.
79-216: sage-grouse core area and habitat, National Register of Historic Places properties, National Historic Trail.
121-221: sage-grouse core area and habitat, National Historic Trail, BLM special management area.

We appreciate the opportunity to comment, and look forward to following up with you to answer any questions you have and provide additional details if requested.

Sincerely,

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Attachments:

- **Attachment 1:** West-wide Energy Corridors Settlement Agreement
- **Attachment 2:** Exhibit A to Settlement Agreement – Corridors of Concern
- **Attachment 3:** Restoration Design Energy Project Screens
- **Attachment 4:** Results of a GIS analysis of conflicts between WWEC and Lands with Wilderness Characteristics
- **Attachment 5:** Results of a GIS analysis of conflicts between WWEC and Citizens' Wilderness Proposal areas
- **Attachment 6:** Map of WWEC conflicts with Historic Rt. 66 and alternative routing along existing corridor in land use plan
- **Attachment 7:** A map of wilderness places intersected by the SE Oregon WWEC
- **Attachment 8:** A zoomed in map of the Alvord Desert WSA area intersected by 24-228
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SETTLEMENT AGREEMENT

Plaintiffs The Wilderness Society, BARK, Center for Biological Diversity, Defenders of Wildlife, Great Old Broads for Wilderness, Klamath-Siskiyou Wildlands Center, National Parks Conservation Association, National Trust for Historic Preservation, Natural Resources Defense Council, Oregon Natural Desert Association, Sierra Club, Southern Utah Wilderness Alliance, Western Resource Advocates, Western Watersheds Project, and County of San Miguel, Colorado ("Plaintiffs"), and Federal Defendants United States Department of the Interior ("DOI"), Kenneth L. Salazar, Secretary of the Interior; United States Bureau of Land Management ("BLM"); Robert Abbey, Director, BLM; United States Department of Agriculture; Tom Vilsack, Secretary of Agriculture; United States Forest Service ("FS"); Tom Tidwell, Chief of the Forest Service; United States Department of Energy ("DOE"); and Steven Chu, Secretary of Energy ("Defendants") (collectively the "Parties"), by and through their undersigned counsel, hereby agree and stipulate as follows:

WHEREAS, on July 7, 2009, Plaintiffs filed the Complaint in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.), which Plaintiffs amended on September 14, 2009;

WHEREAS Plaintiffs' Amended Complaint alleges violations of the Energy Policy Act of 2005, P.L. 109-58 ("EPAct"), the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq*. ("NEPA"), the Federal Land Policy and Management Act, 43 U.S.C. § 1763 *et seq*. ("FLPMA"), the Endangered Species Act, 16 U.S.C. § 1531 *et seq.* ("ESA"), and the Administrative Procedure Act, 5 U.S.C. § 551 *et seq*. ("APA");

WHEREAS Section 368 of the EPAct, 42 U.S.C. § 15926(a), directs the Secretaries of Agriculture, Commerce, Defense, Energy, and Interior, in consultation with the Federal Energy Regulatory Commission, States, tribal or local units of government as appropriate, affected utility industries, and other interested persons, to designate corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land, beginning with 11 western States ("section 368 Corridors");

WHEREAS Section 368 of the EPAct further directs the Secretaries of Agriculture, Commerce, Defense, Energy, and Interior to "perform any environmental reviews required to complete the designation" of the corridors and to formalize the designations by "incorporat[ing] the designated corridors into the relevant agency land use and resource management plans or equivalent plans," 42 U.S.C. §§ 15926(a)(2) and 3;

WHEREAS, on November 20, 2008, Defendants issued a Final Programmatic Environmental Impact Statement for the section 368 Corridors, 73 Fed. Reg. 72,521 (Nov. 28, 2008);

WHEREAS, on January 14, 2009, the Deputy Assistant Secretary, Land and Minerals Management, signed a Record of Decision, amending 92 BLM land use plans to incorporate designation of the Section 368 Corridors;

WHEREAS, on January 14, 2009, the Undersecretary of the Department of Agriculture signed a Record of Decision amending 38 National Forest Land Management plans to incorporate designation of the Section 368 Corridors;

WHEREAS the Parties wish to implement this Settlement Agreement to resolve Plaintiffs' Amended Complaint in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.), and thereby avoid protracted and costly litigation and preserve judicial resources;

WHEREAS the Parties have agreed to a settlement of these matters without any adjudication or admission of fact or law by any party; and

WHEREAS the Parties believe that this Agreement is in the public interest;

the Parties now agree as follows:

I. SCOPE OF AGREEMENT

A. This Agreement shall constitute a complete and final settlement of Plaintiffs' Amended Complaint in *The Wilderness Society, et al. v. United States Department of Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.).

B. This Agreement in no way affects the rights of the United States as against any person not a party hereto.

C. Nothing in this Agreement shall constitute an admission of fact or law by any party. This Agreement shall not be used or admitted in any proceeding against a party over the objection of that party.

D. This Settlement Agreement constitutes the final, complete, and exclusive agreement and understanding between the Parties and supersedes all prior agreements and understandings, whether oral or written, concerning the subject matter hereof. No other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Settlement Agreement or the settlement it represents, nor shall it be used in construing this Settlement Agreement. It is further expressly understood and agreed that this Agreement was jointly drafted by the Parties. Accordingly, the Parties agree that any and all rules of construction to the effect that ambiguity is construed against the drafting party shall be inapplicable in any dispute concerning the terms or interpretation of this Agreement.

E. This Agreement shall be governed by and construed under federal law.

F. Nothing in this Settlement Agreement shall constitute, or be construed to constitute, a waiver of sovereign immunity by the United States. Nothing in the terms of this Agreement shall be construed to limit or modify the discretion accorded Defendants by the APA, the EPAct, NEPA, FLPMA, the ESA, or by general principles of administrative law.

G. The Parties agree that Defendants' obligations under this Settlement Agreement are contingent upon the availability of appropriated funds and that nothing contained in this Settlement Agreement shall be construed as a commitment or requirement that Defendants obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. §1341, or other applicable law.

II. SPECIFIC PROVISIONS

A. This Agreement consists of the following five provisions: an interagency Memorandum of Understanding ("MOU") addressing periodic corridor reviews; agency guidance; training; corridor study; and IM 2010-169. The objectives of these settlement provisions are to ensure that future revision, deletion, or addition to the system of corridors designated pursuant to section 368 of EPAct consider the following general principles: location of corridors in favorable landscapes, facilitation of renewable energy projects where feasible, avoidance of environmentally sensitive areas to the maximum extent practicable, diminution of the proliferation of dispersed rights-of-way ("ROWs") crossing the landscape, and improvement of the long-term benefits of reliable and safe energy transmission. In addition, revisions, deletions, or additions to section 368 corridors are to be made through an open and transparent process incorporating consultation and robust opportunities for engagement by tribes, states, local governments, and other interested parties.

1. Interagency MOU: The BLM, FS, and DOE (the "Agencies") will periodically review the section 368 corridors, as provided in Section 1.a.-c. below, on a regional basis to assess the need for corridor revisions, deletions, or additions. The agencies will establish an MOU describing the interagency process for conducting these reviews, the types of information and data to be considered, and the process for incorporating resulting recommendations in BLM and FS land use plans. DOE's role will be limited to providing technical assistance in the areas of transmission adequacy and electric power system operation, as needed. As part of the periodic review process, the BLM and the FS will re-evaluate those corridors identified by plaintiffs as having specific environmental issues, attached as Exhibit A.[1] The BLM and the FS

[1] Corridors of Concern: The corridors identified by plaintiffs are referred to here as "corridors of concern."

will also concurrently review their existing Interagency Operating Procedures ("IOPs") to identify any revisions, deletions, and additions necessary.

These items will comprise the elements of an interagency MOU to establish a process for periodic review of section 368 corridors and the IOPs.

a. Interagency Workgroup:

- The agencies will establish an interagency workgroup composed of national office and field personnel, as appropriate.
- The workgroup will identify new relevant information (below at b.) that is pertinent to the consideration of section 368 corridors.
- The workgroup shall examine this new relevant information, review the corridors based on this information, and develop recommendations for any revisions, deletions, or additions to the section 368 corridors.
- The BLM and the FS shall ensure that recommendations are conveyed to appropriate agency managers and staff and that these recommendations are fully considered, as appropriate under applicable law, regulations, and agency policy and guidance.
- The BLM and the FS shall ensure that the siting principles (below at c.) are fully considered and public, tribal, and governmental involvement commitments (below at f.) are fully met.

b. Review materials: The new relevant information that the workgroup will review includes, but is not limited to:

- Results of the joint studies of electric transmission needs and renewable energy potential currently being conducted by the Western Electricity Coordinating Council ("WECC") and the Western Governors' Association ("WGA"), and funded by the DOE;
- Results of BLM's eco-regional assessments that characterize the ecological values across regional landscapes;

- Agency Corridor Study of current use of section 368 corridors and IOPs (below at Section 4.);
- Other on-going resource studies, such as the WGA wildlife corridor study, the BLM's National Sage-Grouse Habitat Conservation Strategy, and the State of Wyoming's sage grouse strategy; and
- Current studies and other factors, such as states' renewable portfolio standards, that address potential demand, source, and load with particular regard to renewable energy.

c. Corridor Siting Principles: The Agencies shall review the following areas to ensure that the general principles listed here were considered in siting the current corridors, especially with regard to efficient use of the landscape: (i) northeastern California and northwestern Nevada, (ii) southern California, southeastern Nevada, and western Utah, and (iii) southern Wyoming, northeastern Utah, and northwestern Colorado. The BLM and the FS will make future recommendations for revisions, deletions, and additions to the section 368 corridor network consistent with applicable law, regulations, agency policy and guidance, and will also consider the following general principles in future siting recommendations:

- Corridors are thoughtfully sited to provide maximum utility and minimum impact to the environment;
- Corridors promote efficient use of the landscape for necessary development;
- Appropriate and acceptable uses are defined for specific corridors; and
- Corridors provide connectivity to renewable energy generation to the maximum extent possible while also considering other sources of generation, in order to balance the renewable sources and to ensure the safety and reliability of electricity transmission.

d. **Interagency Operating Procedures:** The BLM and the FS shall review the IOPs adopted in their respective Records of Decision designating energy corridors (January 2009). The BLM and the FS shall review the current utility of the IOPs and pertinent new data and shall actively solicit suggestions from stake-holders for changes to the IOPs. The BLM and FS shall consider new IOPs submitted by Plaintiffs for specific resources including, but not limited to, wildlife, wilderness characteristics, and special areas. The BLM and the FS shall develop recommendations for updating the IOPs concurrently with their periodic review of section 368 corridors.

e. **Implementation of Workgroup Recommendations:** Workgroup recommendations for section 368 corridor revisions, deletions, or additions will be considered for implementation through the BLM and the FS land use planning and environmental review processes. There are three circumstances when such consideration may occur:

- During the normal course of land use plan(s) revisions;
- During an amendment to a land use plan(s) caused by a specific project proposal that does not conform to a land use plan, or when issues within a designated section 368 corridor necessitate review of an alternative corridor path; or
- During an amendment to individual land use plans specifically to address corridor changes.

BLM and FS will adopt recommended changes to the IOPs (additions, revisions, deletions) through internal guidance or manuals or handbooks.

f. **Stakeholder Participation:** There will be two significant opportunities for stakeholder participation:

- The workgroup will provide information to and solicit comment from the public regarding its periodic review of corridors and consequent recommendations, and also engage in consultation with other federal agencies, tribes, states, local governments, and other interested persons through an active exchange of information and opinion during review and before the workgroup makes a recommendation(s). Workgroup members will use this same process in their periodic review of BLM and FS IOPs and recommendations therefor. The MOU will outline appropriate means for conducting outreach, which may include listening sessions/information sharing, web postings/comments, or other appropriate means.

- Any land use plan amendments that consider workgroup recommendations will require evaluation under NEPA in accordance with applicable law, regulations, and agency policy and guidance. The agencies agree to a robust public involvement process and will ensure that:
  - The NEPA process follows agency procedures, including all applicable opportunities for stakeholder, tribal, state, and local government participation;
  - All potentially interested parties are provided opportunities to participate in scoping and the environmental review process as required by agency procedures;
  - Opportunities for full involvement of minority populations, low-income communities, and tribes are promoted and provided by the agencies.

g. Agency Responsibilities:

- BLM, FS, and DOE will each identify an official responsible for implementation of this settlement agreement.
- The DOE shall provide technical review, advice, and assistance regarding:
  - The need for proposed energy transport facilities;
  - The practical functionality of section 368 corridors;

  - o The impact on reliability and electric system operation for facilities located outside section 368 corridors; and
  - o Other technical factors relevant to siting energy transport facilities.
- The BLM and the FS will make recommendations for revisions, deletions, and additions to section 368 corridors and ensure that these recommendations are considered, consistent with applicable law, regulations, agency policy and guidance, and this Agreement.

h. **Working Group Duration:** The interagency workgroup will convene upon signing the MOU and remain in effect until any of its participating agencies determines that the workgroup no longer serves a purpose, but no less than two years following the signing of the MOU. The workgroup shall provide a brief annual report to each agency's MOU signatory, assessing the effectiveness of the workgroup, progress on the settlement agreement commitments, and the current utility of the group. The report will be made available to the public along with a summary of any revisions, deletions, or additions to the section 368 corridors completed at that time.

2. Agency Guidance: The BLM and the FS agree to issue internal guidance to managers and staff regarding use and development of the section 368 corridors. As part of this guidance, the agencies will provide direction on using corridors of concern and will identify known conflicts within these corridors. The BLM and the FS will also issue direction, consistent with applicable NEPA regulations, on how to use the Final Programmatic Environmental Impact Statement ("FPEIS"), *Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386)*, when preparing site-specific NEPA documents.

The BLM and the FS shall develop coordinated guidance for agency managers regarding use of section 368 corridors, and the guidance shall include the following elements:

a. **Corridor Use:** BLM and FS managers will: encourage project proponents to locate projects within designated corridors or adjacent to existing rights-of-way; notify project proponents of any section 368 corridor segments that are corridors of concern; and consider alternative locations if a proposed project would be located within a section 368 corridor of concern segment. The agencies recognize that siting projects within corridors will require site-specific environmental analysis, as well as review of land use plans, as required by applicable law, regulations, and agency policy and guidance.

b. Corridors of Concern: BLM and FS managers will be notified of those corridors of concern set forth by the plaintiffs at Exhibit A and the concerns identified there. Managers and the public will be notified that siting projects within these corridors will likely lead to heightened public interest and concern and may:

- Be challenged;
- Involve significant environmental impacts;
- Involve substantially increased or extensive mitigation measures such as off-site mitigation to compensate for impacts to sensitive resources;
- Include preparation of an environmental impact statement;
- Include consideration of alternatives outside the corridor and consideration of an alternative that denies the requested use; and
- Include amendment of the applicable land use plan to modify or delete the corridor of concern and designate an alternative corridor.

c. Use of the FPEIS:

- BLM and FS will be reminded that site-specific projects in a section 368 corridor will require individual NEPA analysis. The scope of that NEPA review will include analysis of whether the use of that corridor identified in the FPEIS is appropriate in the context of the site-specific project and/or whether additional analysis should be undertaken to modify or delete the corridor and designate an alternative corridor.

- BLM and FS will encourage "incorporation by reference" of data and studies in the FPEIS and other relevant documents, as appropriate for individual projects and consistent with NEPA regulations, in order to reduce bulky and redundant studies.
- BLM and FS managers will be directed that tiering to the FPEIS is not a substitute for site-specific analyses of any project proposed within a section 368 corridor and that environmental reviews of projects within section 368 corridors are subject to this settlement agreement and the NEPA regulations at 40 C.F.R. § 1502.20 and 40 C.F.R. § 1508.28.

d. **Implementation of IOPs:** Guidance will include:

- Procedures for periodic review and update of IOPs, based on the principles of adaptive management and including stakeholder engagement;
- Use of IOPs outside designated corridors on Federal lands; and
- Adoption of IOPs considered and approved by the agencies, particularly with reference to wilderness characteristics, wildlife, and special areas.

e. **Corridor Changes:** Guidance will remind managers that revisions, deletions, and additions to section 368 corridors must (at a minimum) meet the requirements specified for these corridors in section 368 of the EPAct and must consider the siting principles identified in section 1.c. above.

3. Training: The BLM and the FS agree to incorporate environmental concerns into agency training regarding the processing of applications for pipeline and electricity transmission ROWs, and to invite participation from representatives of environmental groups, tribes, and industry in such courses. The BLM and the FS agree to review existing training materials and incorporate an increased emphasis on environmental considerations when siting and permitting pipelines and transmission lines. Specifically these courses are the BLM's Electric Systems Short Course offered once annually at the BLM National Training Center in Phoenix, Arizona; the BLM's Pipelines Systems Course offered once annually in Durango, Colorado; and the

National Lands Training for Line Officer and Program Managers, which is jointly offered by the BLM and FS once annually in various locations.

4. Corridor Study: The BLM and the FS agree to study section 368 corridors in order to assess their overall usefulness with regard to various factors, including their effectiveness in reducing the proliferation of dispersed ROWs crossing the landscape of federal lands.

The agencies will study the section 368 corridors to assess their efficient and effective use and record practical lessons learned. The interagency workgroup will develop a corridor monitoring plan to support this study. The study is anticipated to involve an identification of the types and numbers of projects within the corridors, as well as the widths and lengths of existing ROWs within the corridors. The study would also identify where corridors are being over- or underutilized and would evaluate use of the IOPs in order to recommend potential new or modified IOPs. The study will inform the periodic review of section 368 corridors and IOPs (above at 1.b.) and be made public upon completion.

5. IM 2010-169**:** BLM agrees to delete a section, entitled “Environmental Review and Energy Corridors,” from Instruction Memorandum No. 2010-169, dated July 28, 2010, upon issuance of a new BLM instruction memorandum setting forth guidance for the siting and construction of electric transmission infrastructure in section 368 corridors. BLM Instruction Memorandum No. 2010-169, dated July 28, 2010, is entitled “Implementation Guidance for the Interagency Transmission Memorandum of Understanding.” The memorandum of understanding referred to was entered into by nine federal agencies in October 2009 to expedite the siting and construction of qualified electric transmission infrastructure in the United States. IM 2010-169 contains a three-paragraph section entitled “Environmental Review and Energy Corridors,” which addresses section 368 corridors and directs BLM managers to tier to the environmental analysis in the FPEIS to the extent the FPEIS addresses anticipated issues and concerns associated with individual qualifying projects.

B. **Time Line for Implementation of Agreement**

The agencies agree to make every effort to meet the timelines identified below. Should the agencies be unable to meet these internal timelines for any reason, the BLM Assistant Director for Minerals and Realty Management will notify the plaintiffs and explain the circumstances causing the delay.

- Upon the Effective Date (see Section III.I) of the settlement agreement, the provisions of section II.A.2.c. shall apply.
- Upon the Effective Date of the settlement agreement, the agencies will complete a MOU within twelve months. Progress on completion of the MOU will be reported quarterly to the plaintiffs. The final MOU will be made available to the public. Upon signing the MOU, the agencies will commence a periodic review of section 368 corridors, with recommendations due twelve months thereafter.
- Upon the Effective Date of the settlement agreement, the BLM and the FS will initiate a review of current guidance. New guidance will be developed concurrently with the MOU and will be completed within twelve months. Progress on completion of guidance will be reported quarterly to the plaintiffs. New guidance will be made available to the public.
- Upon the Effective Date of the settlement agreement, the BLM and the FS will initiate a review of current training materials, instructors, and outreach efforts. Within three months the BLM and the FS will identify representatives to be invited to participate in future training. Within twelve months training courses will be revised. Progress on completion of training revisions will be reported quarterly to the plaintiffs.
- Upon the Effective Date of the settlement agreement, the agencies will initiate development of a plan to study use of the section 368 corridors. The agencies will complete the work plan within twelve months of the Effective Date of the settlement agreement. The study will be completed within twelve months of completion of the work plan. The workgroup will report progress on the study quarterly to the plaintiffs.

III. EFFECT OF SETTLEMENT

A. Subject to Defendants' compliance with the terms of Paragraphs II.A. and II.B. of this Agreement, Plaintiffs release all claims in *The Wilderness Society, et al. v. United States Department of the Interior, et al.*, No. 3:09-cv-03048-JW (N.D. Cal.).

B. Subject to the provisions of paragraph F below, upon signing the settlement agreement, plaintiffs will stipulate to the dismissal with prejudice of their amended complaint in *The Wilderness Society, et al. v. Department of the Interior, et al.*, No. 03:09-cv-03048 JW (N.D. Cal.). However, the Court shall retain jurisdiction over this action for the limited purpose of resolving settlement implementation disputes pursuant to the provisions of Paragraph F, below, until each of the following events has occurred: (1) 24 months have elapsed following execution of the MOU in accordance with Section II.A.1, above; and (2) the following undertakings have been completed: (a) new guidance has been developed in accordance with Section II.A.2, above; (b) training materials have been revised in accordance with Section II.A.3, above; (c) the Corridor Study has been completed in accordance with Section II.A.4, above; and (d) IM 2010-169 is revised in accordance with Section II.A.5, above.

C. The Federal Defendants, through the BLM and the FS, shall pay Plaintiffs the sum of $30,000.00, in full settlement and satisfaction of all of Plaintiffs' claims for attorneys' fees, costs, and other expenses in the above-captioned case. Payment shall be accomplished by electronic fund transfer. Within 5 business days of the date this Settlement Agreement is filed, Plaintiffs shall submit (if not already submitted) the account information and other information necessary for the Federal Defendants to process payment. The BLM and the FS shall undertake the procedures for processing payment within 20 days after this Settlement Agreement is filed or Plaintiffs submit the required payment information, whichever is later.

1. Release: Plaintiffs will accept the sum of $30,000.00 in full settlement and satisfaction of all of their claims for attorneys' fees, costs, and other expenses in this matter and release the Federal Defendants from any liability for attorneys' fees, costs, and other expenses incurred or claimed, or that could have been claimed, for work performed on this case, under the

Equal Access to Justice Act, 28 U.S.C. § 2412, or under any other federal or state statute or common law. Plaintiffs or their counsel shall submit confirmation of receipt of payment in the above amount to counsel for Federal Defendants, within 14 days of receipt of payment.

2. Payee: Plaintiffs represent that the proper entity to receive payment pursuant to this Settlement Agreement is Earthjustice (tax ID is 94-1730465). Payment shall be made to Earthjustice by Electronic Funds Transfer payable to:

Mechanics Bank
725 Alfred Nobel Drive
Hercules, California 94547
Bank Routing #121102036
ACCT # 040-882578

Plaintiffs and their attorneys agree that the Federal Defendants' responsibility in discharging the payment obligation provided in this Settlement Agreement consists only of making the payment to Earthjustice in the manner set forth herein.

D. Any term set forth in this Agreement (including deadlines and other terms) may be modified by written agreement of the Parties.

E. Except as expressly provided in this Agreement, neither of the Parties waives or relinquishes any legal rights, claims, or defenses it may have.

F. In the event of a disagreement among the Parties concerning the performance of any aspect of this Agreement, the dissatisfied party shall provide the other party with written notice of the dispute and a request for negotiations. The Parties shall meet and confer in order to attempt to resolve the dispute within 30 days of the date of the written notice, or such time thereafter as is mutually agreed. If the Parties are unable to resolve the dispute within 90 days after such meeting, then any Party may apply to the Court for resolution. In resolving such dispute, the Court's review shall be limited to determining: (1) whether the Federal Defendants have reasonably complied with the performance deadlines set forth in Section II.B; (2) whether the MOU required by Section II.A.1 contains the terms required by this Agreement; (3) whether the guidance issued in accordance with Section II.A.2 contains the terms required by this Agreement; (4) whether the training developed by the agencies addresses the issues identified in

Section II.A.3; (5) whether the study prepared by the agencies contains the terms set forth in Section II.A.4; and (6) whether IM 2010-169 has been revised in accordance with Section II.A.5. The Parties agree that any challenge to a final decision concerning amendments or revisions to land use plans, as well as to final decisions concerning revisions, deletions, or additions to Section 368 corridors, must take the form of a new civil action under the judicial review procedures of the Administrative Procedure Act, 5 U.S.C. §§ 701–706. The parties will not seek the remedy of contempt for any alleged violation of the settlement agreement.

G. Any notices required or provided for under this Agreement shall be in writing, shall be effective upon receipt, and shall be sent to the following:

For Plaintiffs:

BARK
Alex Brown, Executive Director
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Portland, OR 97214
alex@bark-out.org
503-331-0374

Center for Biological Diversity
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Portland, OR 97211-0374
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Fax: (503) 283-5528
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Defenders of Wildlife
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202-772-3273
ELIEBERMAN@defenders.org

Great Old Broads for Wilderness
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Klamath Siskiyou Wildlands Center
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National Parks Conservation Association
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Western Resource Advocates
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Western Watersheds Project
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<u>For Defendants</u>:

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Meredith L. Flax
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Environment and Natural Resources Division
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E-mail: meredith.flax@usdoj.gov

H. Upon written notice to the other party, either party may designate a successor contact person for any matter relating to this Agreement.

I. The undersigned representatives of each party certify that they are fully authorized by the parties they represent to bind the respective Parties to the terms of this Agreement. This Agreement shall become effective upon signature on behalf of all of the Parties set forth below and upon the Court's entry of an order of dismissal in accordance with Section III.B above (the "Effective Date"). This Agreement may be executed in any number of counterpart originals, each of which shall be deemed to constitute an original agreement, and all of which shall constitute one agreement. The execution of one counterpart by any party shall have the same force and effect as if that party has signed all other counterparts.

ON BEHALF OF ALL PLAINTIFFS

DATED: July 3, 2012

/s/James S. Angell

JAMES S. ANGELL
(Admitted *pro hac vice*)
Earthjustice
1400 Glenarm Place, Suite 300
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GREGORY C. LOARIE
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Earthjustice
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Counsel for Plaintiffs, The Wilderness Society, Bark; Center for Biological Diversity; Defenders of Wildlife; Great Old Broads for Wilderness; Klamath-Siskiyou Wildlands Center; National Parks Conservation Association; National Trust for Historic Preservation; Natural Resources Defense Council; Oregon Natural Desert Association; Sierra Club; Southern Utah Wilderness Alliance; Western Resource Advocates; Western Watersheds Project; County of San Miguel, CO

AMY R. ATWOOD
(Admitted *pro hac vice*)
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Counsel for Plaintiffs, Center for Biological Diversity; The Wilderness Society; Klamath-Siskiyou Wildlands Center; and San Miguel County, Colorado

FOR THE FEDERAL DEFENDANTS:

IGNACIA S. MORENO
Assistant Attorney General

DATED: July 3, 2012

/s/ David B. Glazer

DAVID B. GLAZER
Natural Resources Section
Environment and Natural Resources Div.
United States Department of Justice
301 Howard Street, Suite 1050
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Telephone: (415) 744-6491
Facsimile: (415) 744-6476
e-mail: david.glazer@usdoj.gov

ATTORNEY ATTESTATION OF CONCURRENCE

I hereby attest that I have obtained concurrence in this filing and for affixing the signature of Plaintiffs' counsel, indicated by a "conformed" signature ("/s/"), to this e-filed document, in accordance with General Order 45.X.

Dated: July 3, 2012

/s/*David B. Glazer*
DAVID B. GLAZER
Natural Resources Section
Environment and Natural Resources Division
United States Department of Justice
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San Francisco, California 94105
Telephone: (415) 744-6491
Facsimile: (415) 744-6476
E-mail: david.glazer@usdoj.gov

Exhibit A
To
Settlement Agreement,
The Wilderness Society et al. v. United States Department of the Interior et al.,
3:09-cv-03048 JW (N.D. Ca.)

Per Section II.A.1. of the above-captioned Settlement Agreement, “corridors identified by plaintiffs as having specific environmental issues” are listed below, along with plaintiffs’ concerns over affected resources as identified by plaintiffs in the above-captioned lawsuit. Corridor numbers in boldface correspond to those set forth in Appendix A of the Programmatic Environmental Impact Statement, *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386, November 2008) and in the Records of Decision issued by the Bureau of Land Management and U.S. Forest Service in January 2009.

WASHINGTON
102-105: numerous “suitable” segments under Wild & Scenic Rivers Act, borders designated Wilderness, Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves, crosses Pacific Crest Trail, tracks America’s Byway within 1 mile, National Register of Historic Places property.
244-245: conflicts with Northwest Forest Plan, critical habitat, tracks America’s Byway.

OREGON
7-24: 3 citizen-proposed wilderness areas, sage-grouse habitat, pygmy rabbit habitat, Steens Mountain Cooperative Management Area, and proposed Sheldon Mountain National Wildlife Refuge.
230-248: critical habitat, National Register of Historic Places property, Pacific Crest Trail, Clackamas Wild & Scenic River and other “eligible” segments under Wild & Scenic Rivers Act, conflicts with Northwest Forest Plan critical habitat and late-successional/ adaptive management reserves.
24-228 (also in Idaho): sage-grouse habitat, National Register of Historic Places property.
4-247 – not close enough to QRA, old-growth forests, critical habitat, late-successional reserves, riparian reserves.

IDAHO
24-228 (also in Oregon): sage-grouse habitat, pygmy rabbit habitat.
229-254 (also in Montana - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act.

WYOMING
Any in core areas are prohibited for transmission use by BLM guidance.
78-255: sage-grouse core area and habitat.
79-216: sage-grouse core area and habitat, National Register of Historic Places properties, National Historic Trail.
121-221: sage-grouse core area and habitat, National Historic Trail, BLM special management area.

MONTANA
229-254 (also in Idaho - 3 segments – regular, (N) and (S)): critical habitat, National Register of Historic Places properties, “suitable” segment under Wild & Scenic Rivers Act, Continental Divide Trail, USFS Inventoried Roadless Area.

CALIFORNIA
18-23: Areas of Critical Environmental Concern, Inventoried Roadless Areas, BLM Wilderness Study Areas, CA Boxer Wilderness, CA-proposed Wilderness, NV-proposed Wilderness, sage-grouse habitat, redundant to 18-224.
23-106: National Conservation Area, Area of Critical Environmental Concern.
23-25: critical habitat, National Conservation Area, Area of Critical Environmental Concern.
264-265: critical habitat, National Conservation Area, citizen-proposed Wilderness, USFS Inventoried Roadless Area.
107-268: National Forest, citizen-proposed Wilderness.
101-263: critical habitat; WSR; CA-proposed Wilderness, citizen-proposed Wilderness, USFS Inventoried Roadless Area.

NEVADA
17-35: access to coal plant, impacts to sage-grouse habitat.
16-24: Wilderness, National Conservation Area, National Historic Place, BLM Wilderness Study Area (in Oregon).
16-104: BLM Wilderness Area.
44-110: sage-grouse habitat.
110-233: sage-grouse habitat.
110-114: sage-grouse habitat, undisturbed, USFS Inventoried Roadless Area.
223-224: Areas of Critical Environmental Concern, Desert National Wildlife Refuge.
39-113, 39-231: Pahranagat National Wildlife Refuge, Rainbow Gardens ACEC, near proposed Gold Butte National Conservation Area, Black Mountain tortoise habitat.

UTAH
110-114: much undisturbed, National Historic Place, BLM Wilderness Study Area, UT-proposed Wilderness.
66-259: access to coal plant, impacts to USFS Inventoried Roadless Area.
66-212: access to coal plant, impacts to National Historic Places, America’s Byways, Old Spanish Trail, BLM Wilderness Study Area, UT-proposed Wilderness, critical habitat, adjacent to Arches National Park.
116-206: undisturbed, monument, Old Spanish Trail, UT-proposed Wilderness, near USFS Inventoried Roadless Area.
68-116, Grand Staircase National Monument, Paria River.
126-258: access to coal plant.

COLORADO
130-274 and 130-274(E): access coal, directly or indirectly impacts Gunnison sage-grouse conservation areas, occupied Gunnison sage-grouse habitat, CO-proposed Wilderness, USFS IRA.
87-277: coal, Wilderness, sage-grouse habitat; National Historic Places.
144-275: coal, wilderness, National Historic Places.

ARIZONA
68-116: access to coal, impacts to Grand Staircase-Escalante National Monument, Wild & Scenic Rivers, scenic byway.
62-211: access to coal, impacts to citizen-proposed and designated Wilderness, National Historic Place, Wild & Scenic Rivers, Mexican spotted owl critical habitat.
47-231: desert tortoise and bonytail critical habitat, Area of Critical Environmental Concern, Lake Mead National Recreation Area.
41-47: impacts to Black Mountain population for desert tortoise.
41-46: impacts to Black Mountain population for desert tortoises.
46-270: Wild & Scenic river, Southwestern willow flycatcher critical habitat.
46-269: proposed and designated Wilderness areas, Wild and Scenic Rivers, Three Rivers Area of Critical Environmental Concern.

NEW MEXICO
81-272: Sevilleta National Wildlife Refuge, National Conservation Areas.

Table 2-1
Areas with Known Sensitive Resources Eliminated from REDA Consideration

Areas with Known Sensitive Resources	Source
BLM Areas of Critical Environmental Concerns	BLM 2011
BLM Backcountry Byways	BLM 2011
BLM Designated Wilderness and Wilderness Study Areas	BLM 2011
BLM lands with wilderness characteristics managed to protect those characteristics	BLM 2011
BLM lands with wilderness characteristics not managed to protect those characteristics	BLM 2011
BLM Visual Resource Management Classes I, II, and III	BLM 2011
BLM Special Recreation Management Areas	BLM 2011
BLM ROW exclusion or avoidance areas	BLM 2011
BLM Herd Management Areas	BLM 2011
Gila River Terraces ACEC	BLM 2011
Cultural sites well documented by the BLM, including House Rock Valley, Poston Butte, Petrified Forest Expansion Area, Gila River Terraces , and Clanton Hills	BLM 2011
Designated BLM utility corridors	BLM 2011
National Monuments	BLM 2011
National Conservation Areas	BLM 2011
Wild and Scenic Rivers (either eligible for or suitable for inclusion in the National Wild and Scenic Rivers System or rivers included in the National Wild and Scenic Rivers System)	BLM 2011
National Park System units, including Petrified Forest National Park Expansion Area	BLM 2011, SWReGAP 2011
National Park System National Historic Trails (0.25-mile buffer each side)	BLM 2011
Tribal lands	BLM 2011
Military lands	BLM 2011
State parks	Arizona State Parks 2010
State wildlife areas	BLM 2011
USFWS lands	BLM 2011
The Nature Conservancy conservation easements, Audubon Society land, and private conservation easements	SWReGAP 2011
US Forest Service Designated Wilderness	Forest Service 2010a
US Forest Service Established Research Natural Areas	Forest Service 2010b
US Forest Service Inventoried Roadless Areas	Forest Service 2010c
US Forest Service Heber Wild Horse and Burro Area	Forest Service undated
US Forest Service Special Interest Management Areas	Forest Service 2010b

Table 2-1
Areas with Known Sensitive Resources Eliminated from REDA Consideration

Areas with Known Sensitive Resources	Source
Incorporated cities (except when BLM land is included within the boundaries of an incorporated city)	ALRIS 2011
AGFD Areas of Conservation Potential, Tiers 4, 5, and 6	AGFD 2011
AGFD important big game habitat, including bighorn sheep, black bear, elk, javelina, mountain lion, mule deer, turkey, and white-tailed deer.[1]	AGFD 1988
Special status species, including threatened, endangered, and BLM sensitive species locations	AGFD 2010, BLM 2011
AGFD wildlife corridors	AGFD undated
USFWS critical habitat for threatened and endangered species	USFWS 2010
BLM sensitive species habitat	BLM 2011
Sonoran desert tortoise (*Gopherus agassizii*) Sonoran population habitat categories I, II, and III	BLM 2011
Desert tortoise conservation areas from the Solar PEIS	BLM and DOE 2012b
National Wetland Inventory wetlands	NWI 2010
Water bodies (lakes, rivers, and dry lakes)	BLM 2011
Federal Emergency Management Agency 100-year floodplains	FEMA 2010
Areas of high potential for known mineral deposits, metallic mineral districts, and Holbrook Basin potash potential	AZGS 2008, Arizona Bureau of Geology and Mineral Technology 1983, Arizona Bureau of Mines 1993
Sensitive fossil resources	BLM 2011
Severe soils: Clay Springs (runoff medium to rapid and erosion hazard moderate to severe) and Rositas (wind erosion severe if natural surface and cover disturbed)	BLM 2011, Description of Soil Series 2010
Greater than 5 percent slopes (or greater than 15 percent slopes for areas with wind potential)	USGS 2010, BLM 2011
REDAs less than 8 acres unless contiguous with larger REDAs	BLM 2011

[1]Bighorn sheep high density, medium, low, and sparse; black bear, high, medium, and low; elk summer high, medium, and low plus winter very high, high, medium, and low; javelina high and medium; mountain lion high; mule deer summer Kaibab high and medium, high plus winter Kaibab high and medium, high and medium; turkey summer high and medium plus winter high, medium, and low; white-tailed deer high and medium. Arizona Game and Fish Department describes wildlife density as number of animals per square mile.

ARIZONA	
BLM-inventoried LWC managed for protection	
LWC Unit Name	**WWEC Segment**
Black Canyon Creek	61-207
BLM-inventoried LWC not managed for protection	
LWC Unit Name	**WWEC Segment**
Agua Fria	61-207
Beaver Dam	113-116
Beaver Dam 1	113-116
Buckskin Mountains	46-269
Cedar Mountain	68-116
East Mesa	113-116
Hacuvars	46-269
Harquahala Mountains	46-269
Hurricane Cliffs	113-116
Mokaac Fault	113-116
Rock Canyon	113-116
Swansea	46-269
Wild_Char	115-238
CALIFORNIA - note that inventory data was only available for the California Desert region	
BLM-identified Potential LWC	
Potential LWC Unit Name	**WWEC Segment**
CA-010-053	18-23
CA-010-054	18-23
CA-010-061	18-23
CA-010-062	18-23
CA-010-063	18-23
CA-060-026	115-238
CDCA-157	18-23
CDCA-157A	18-23
CDCA-157B	18-23
CDCA-158	23-106
CDCA-159	23-106
CDCA-162	23-106
CDCA-174	23-25
CDCA-176	23-25
CDCA-185	23-25
CDCA-186	23-25
CDCA-195	23-25
CDCA-198	23-25
CDCA-200	27-266
CDCA-201	27-266
CDCA-203	27-266
CDCA-204	27-266

CDCA-206	27-41
CDCA-226	27-225
CDCA-227	27-225
CDCA-228	27-225
CDCA-228A	27-225
CDCA-228B	27-225
CDCA-231	27-225
CDCA-242	27-225
CDCA-243	27-225
CDCA-251	27-225
CDCA-251	27-41
CDCA-252	27-41
CDCA-252A	27-41
CDCA-254	27-41
CDCA-254A	27-41
CDCA-255	27-41
CDCA-258	27-41
CDCA-258A	27-41
CDCA-259	27-41
CDCA-275	27-41
CDCA-275A	27-41
CDCA-276	27-41
CDCA-276A	27-41
CDCA-277	27-41
CDCA-277A	27-41
CDCA-278	27-41
CDCA-278A	27-41
CDCA-279	27-41
CDCA-281	27-41
CDCA-297	27-41
CDCA-298	27-41
CDCA-299A	27-41
CDCA-301	27-41
CDCA-302	27-41
CDCA-303	27-41
CDCA-303A	27-41
CDCA-303B	27-41
CDCA-304A	27-41
CDCA-325	30-52
CDCA-325-5	30-52
CDCA-325B	30-52
CDCA-326	30-52
CDCA-330	30-52
CDCA-331	30-52
CDCA-332A	30-52
CDCA-333	30-52
CDCA-348	30-52

CDCA-349	30-52
CDCA-349-3	30-52
CDCA-350	30-52
CDCA-351	30-52
CDCA-355A	115-238
CDCA-356	115-238
CDCA-357	115-238
CDCA-364	115-238
CDCA-365	115-238
CDCA-365	115-238
CDCA-366	115-238
CDCA-367	115-238
CDCA-368	115-238
CDCA-369	115-238
CDCA-370	115-238
CDCA-372	115-238
CDCA-373	115-238
Citizen-inventoried LWC	
LWC Unit Name	**WWEC Segment**
Argos	27-41
Ash Hill	27-41
Hollow Hills Additions	27-225
Newberry Mtns Additions 1	27-41
Newberry Mtns Additions 6	27-41
Orocopia Mtns Additions 5	30-52
Ragtown	27-41
COLORADO	
BLM-identified Potential LWC	
Potential LWC Unit Name	**WWEC Segment**
Badger Creek South	87-277
Big Hole, Old #296, Polygons & cherry stem removed due	73-133
Blair Mtn/Greasewood	132-133
Cherokee Draw, Old #s 237 & 238, AECOM #291, Polygons	73-133
CO-070-033and034	132-276
CO-070-302and032	132-133
CO-070-302and032	132-136
CO-070-322	132-276
CO-070-RoanC Northeast Cliffs	132-276
Coal Oil Gulch	126-133
COF-020-017-A	87-277
Cooper Mountain	87-277
Crampton Mountain subunit	87-277
Crampton Mountian	87-277
Crooked Wash, Old #s 285 & 291, AECOM #479, Cherry st	132-133
Crooked Wash, Old #s 285 & 291, AECOM #479, Excluded	126-133

Crooked Wash, Old #s 285 & 291, AECOM #479, Polygon r	126-133
Crooked Wash, Old #s 285 & 291, AECOM #479, Polygons	132-133
Echo Canyon	87-277
Eightmile Mountain	87-277
Ernie Howard Gulch	132-133
Greasewood Gulch, Old #312, Polygon removed by BLM d	73-133
Greasewood Gulch, Old #312, Polygons removed by BLM (	73-133
Juniper Mountain, Old #s 283 & 287, AECOM #218, Polygo	133-142
Juniper Mountain, Old #s 283 & 287, Polygon removed by	133-142
Juniper Mountain, Old #s 283 & 287, Polygon removed by	133-142
Little Horsethief Creek	132-136
Little Yampa Canyon, Old #s 290 & 294, AECOM #509, Poly	133-142
Little Yampa Canyon, Old #s 290 & 294, AECOM #509, Poly	133-142
Lower Wolf Creek	126-133
North Badger Creek	87-277
Norwood Canyon	130-131 (S)
Pinyon Ridge, Old #006b, AECOM #481, Polygon removed	126-133
South Shale Ridge	132-133
South Shale Ridge	132-136
Stubbs Gulch	87-277
Sugar Creek	87-277
The Blowout	132-136
Timberlake Creek, Old #304, AECOM #316, Polygon remov	138-143
Citizen-identified Potential LWC in the Kremmling Field Office	
Potential LWC Unit Name	**WWEC Segment**
Barger Gulch/McQueary Gulch	144-275
Wolford Mountain	144-275
Citizen-inventoried LWC in the Grand Junction Field Office	
LWC Unit Name	**WWEC Segment**
Book Cliffs	132-136
Little Horsethief Creek	132-136
South Shale Ridge	132-133
South Shale Ridge	132-136
The Blowout (Palisade)	132-136
MONTANA - note that inventory data was only available for the Billings, Glasgow and Miles City Field Offices	
BLM-inventoried LWC	
LWC Unit Name	**WWEC Segment**
Timber Canyon	79-216
NEW MEXICO - note that inventory data was only available for part of the Las Cruces District	
BLM-identified Potential LWC	

Potential LWC Unit Name	WWEC Segment
NM-LC-010	81-213
NM-LC-011	81-213
NM-LC-012	81-213
NM-LC-013	81-213
NM-LC-016	81-213
OREGON	
See Attachment 8 to comments	
UTAH	
BLM-inventoried LWC	
LWC Unit Name	**WWEC Segment**
	66-212
	116-206
	126-218
Beaver Dam Mountain North	113-114
Behind the Rocks	66-212
Central Wah Wah	110-114
Cold Spring Mountain	126-218
Desolation Canyon	66-212
Goldbar	66-212
Joshua Tree	113-116
Mill Creek Canyon	66-212
North Wah Wah	110-114
Price River	66-212
The Rim Rock B	126-218
Upper Kanab Creek	116-206
WYOMING - note that inventory data were only available for a few field offices	
BLM-identified Potential LWC in the Rawlins Field Office	
Potential LWC Unit Name	**WWEC Segment**
Blue Gap Central	138-143
Blue Gap Outlier 1	138-143
Catalina Central	138-143
Catalina Outlier 3	138-143
Catalina Outlier 5	138-143
Cheorkee Central	138-143
Cheorkee Outlier 1	138-143
Cheorkee Outlier 3	138-143
Cheorkee Outlier 6	138-143
Cheorkee Outlier 7	138-143
Cheorkee Outlier 8	138-143
Cherokee Outlier 2	138-143
Eureka	138-143

George Dew 2	138-143
George Dew 3	138-143
Little Robbers 3	138-143
Little Robbers 4	138-143
Little Snake	138-143
Little Snake River Outlier	138-143
Lower Muddy 1	138-143
Lower Muddy 2	138-143
Lower Muddy 3	138-143
Lower Muddy 4	138-143
Lower Muddy 5	138-143
Lower Muddy 6	138-143
Lower Muddy 8	138-143
Lower Muddy 9	138-143
Mexican Flats	138-143
Muddy Mountain Central	138-143
Muddy Mountain Outlier 2	138-143
Poison Buttes Central	138-143
Robbers Gulch	138-143
Snake Tail	138-143
The Bluffs Central	138-143
The Bluffs Outlier 1	138-143
The Bluffs Outlier 2	138-143
The Bluffs Outlier 3	138-143
The Bluffs Outlier 4	138-143
X-27	138-143
X-54	138-143
X-55	138-143
Adobe Town Fringe Area B	73-133
Adobe Town WSA	73-133
Barrel Springs Draw Central	73-133
Barrel Springs Draw Outlier 3	73-133
Barrel Springs Draw Outlier 4	73-133
Cherokee Creek East Fork	73-133
Church Butte	73-133
CIG Pipeline ROW Corridor	73-133
Courthouse Butte	73-133
Dad Dail Reservoir	73-133
Dripping Rock	73-133
Hartt Cabin Draw Central	73-133
Hartt Cabin Draw Central 4	73-133
Hartt Cabin Draw Central 5	73-133
Hartt Cabin Draw Central 6	73-133
Hartt Cabin Draw Central 7	73-133
Hartt Cabin Draw Central 8	73-133
Hartt Cabin Draw Central 9	73-133
RFO-M	73-133

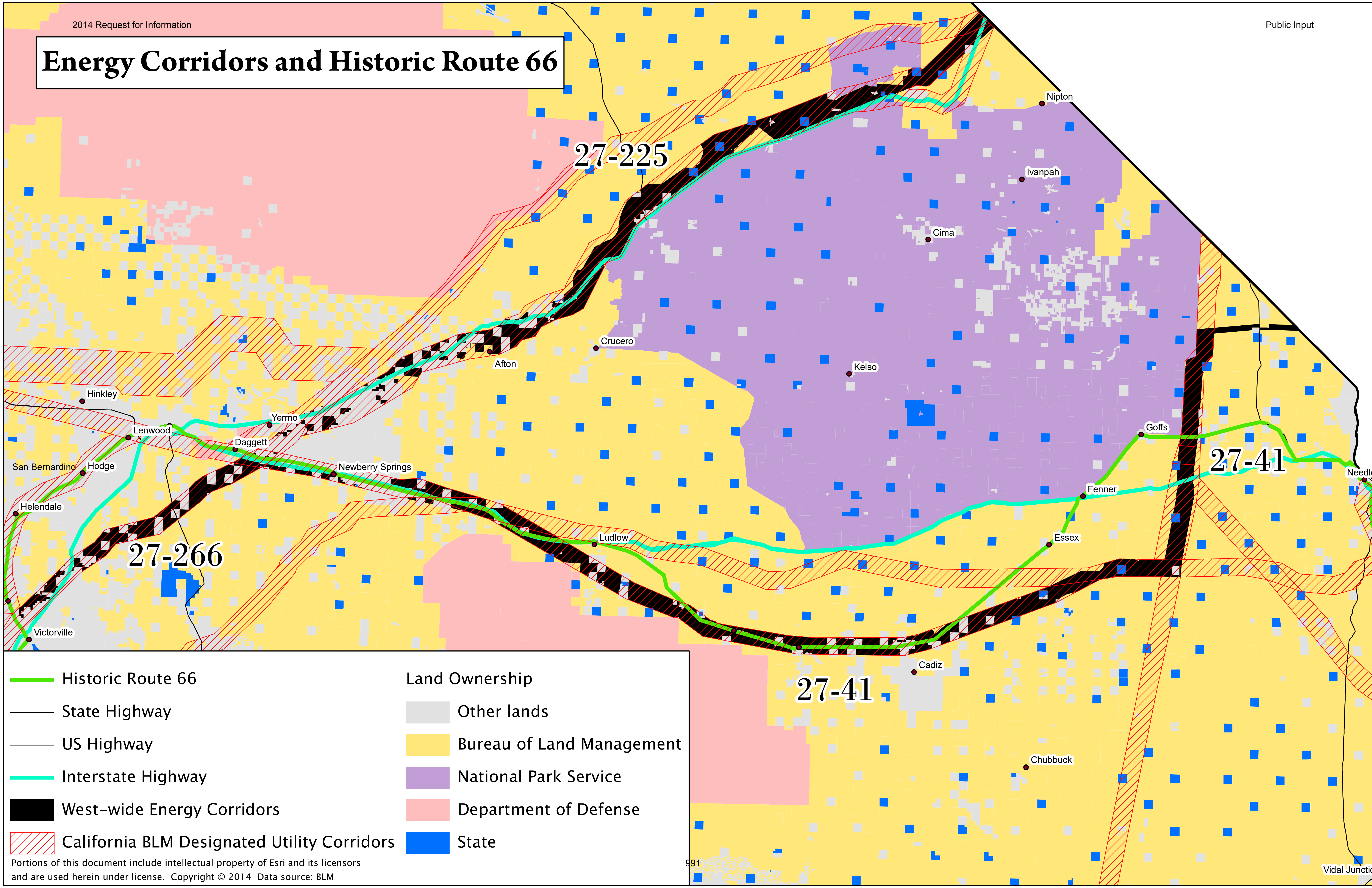
RFO-N	73-133
Rotten Springs	73-133
Willow Creek East	73-133
Willow Reservoir Central	73-133
Willow Reservoir Outlier 1	73-133
Windmil Central	73-133
Windmill Outlier 1	73-133
Moss Agate	78-255
North of Uranium Miners	78-255
RFO-H	78-255
RFO-J	78-255
Sand Creek	78-255
Shirley Basin East	78-255
Thornton	78-255
BLM-inventoried LWC	
LWC Unit Name	**WWEC Segment**
RFO-H	78-255
Rotten Springs	73-133

ARIZONA	
CPW Unit Name	**WWEC Segment**
	113-116
	113-116
	46-269
Black Butte East	46-269
Black Butte West	46-269
Castle Creek Additions	61-207
Dixie Peak	115-238
East Belmont Mountains	46-269
East Mesa	113-116
Face Mountain	115-238
Harcuvar Mountains Additions	46-269
Harquahala WA Addition	46-269
Hellsgate Additions	62-211
Lower Burro	46-270
Mazatzal additions	62-211
Quayle Draw	113-116
Swansea Additions	46-269
Tumacacori	234-235
West Belmont Mountains	46-269
Yellow Medicine Butte	115-238
Proposed NCA Name	**WWEC Segment**
GilaEastNCA	115-208
GilaEastNCA	115-238
HarquahalaNCA	30-52
HarquahalaNCA	46-269
CALIFORNIA	
CWI Unit Name	**WWEC Segment**
Adams Pk PW 2	15-104
Amboy Crater PW	27-41
Ash Hill	27-41
Buffalo Smoke	15-104
Cady Mountains	27-225
Chidago Canyon	18-23
Coldwater	236-237
Coyote Mtns PWA 1Poly	115-238
East Palen Valley PW	30-52
Essex South PW	27-41
Excelsior	18-23
Excelsior PW 1	18-23
Golden Trout PWA	18-23
Hauser Mtn.	115-238
Hollow Hills PWA	27-225
Homer Wash	27-41

Homer Wash 2	27-41
Jacumba PWA 1	115-238
Joshua Tree National Park Additions	30-52
Ladd	236-237
Little Picacho PWA 1	115-238
Little Picacho PWA 2	115-238
Little Picacho PWA 3	115-238
Mayfield	3-8
McCloud Flat PW	18-23
Middle Knob	23-106
Newberry PWA 5 of 6	27-41
Newberry PWA 6 of 6	27-41
Old Woman Mountains PWA	27-41
Orocopia PWA 5	30-52
Piute Mountains PWA 1	27-41
Ragtown East PW	27-41
Shinn Mtn PW	15-104
Skedaddle West PW	15-104
Sleeping Beauty PW	27-41
Soda Mountains	27-225
South Fork Trinity	101-263
South of Argos PW	27-41
South Sierra PWA 1	18-23
South Sierra PWA 4	18-23
South Sierra PWA 5	18-23
Table Mountain	115-238
Trilobite PWA 2	27-41
Volcanic Tablelands	18-23
Volcanic Tablelands PW 2	18-23
Volcanic Tablelands PW 5	18-23
Windy Pt PW	27-41
COLORADO	
CWP Unit Name	**WWEC Segment**
Badger Creek	87-277
Norwood Canyon	130-131 (S)
Norwood Canyon	131-134
Roan Plateau	132-276
South Shale Ridge	132-133
South Shale Ridge	132-136
Yampa River	133-142
MONTANA	
CWP Unit Name	**WWEC Segment**
Elkhorns	229-254
NEVADA	

CWP Unit Name	WWEC Segment
Agai Pah Hills South	18-224
Clayton Ridge North Unit	18-224
Monte Cristos North	18-224
Monte Cristos South	18-224
Perish Peak	110-233
West Wassuks	18-224
West Wassuks	18-23
NEW MEXICO	
CWP Unit Name	**WWEC Segment**
Chupadera Wilderness Addition	81-272
Lordsburg Playas North	81-213
Magdalena Mountains 1	81-272
Magdalena Mountains 2	81-272
Organ Foothills	81-272
Point of Rocks	81-272
Polvadera Mountain	81-272
OREGON	
CWP Unit Name	**WWEC Segment**
Alvord Lake	7-24
Babes Canyon	7-24
Black Point	7-24
Coleman Rim	7-24
Dry Creek	11-228
Freezout Ridge	11-228
Grassy Mountain	11-228
Hart Mountain S	7-24
Hart Mountain SE	7-24
Keeney Ridge	11-228
Middle River	11-228
Owyhee River Canyon Addition	24-228
Saddle Butte	24-228
Sheldon -- includes Nevada proposal	7-24
Spaulding WSA addition 2	7-24
Ten Mile Creek	16-24
Tule Springs	7-24
UTAH	
CWP Unit Name	**WWEC Segment**
Antelope Range	113-114
Arches Adj 6	66-212
Arches Adj. 7	66-212
Behind the Rocks	66-212
Cat Canyon	114-241
Central Wah Wah Mtns	110-114

Cricket Mtn.	114-241
Dead Horse Pass	126-218
Desolation Canyon	66-212
Duma Point	66-212
Goldbar Canyon	66-212
Goslin Mountain	126-218
Hatch\Lockhart\Hart	66-212
Little Sage Valley	114-241
Lost Spring Wash	66-212
Lower Flaming Gorge	126-218
Mill Creek	66-212
Mountain Home	126-218
Mtn. Home Range N.	110-114
North Wah Wah Mtns.	110-114
O-Wi-Yu-Kuts	126-218
Paria Canyon Exp. 2	68-116
Pine Hollow	68-116
Price River	66-212
Red Creek Badlands	126-218
Split Mtn Benches S.	126-218
Split Mtn. Benches	126-218
Upper Kanab Creek	116-206
Vermilion Cliffs	116-206
WYOMING	
CWP Unit Name	**WWEC Segment**
Adobe Town	73-133

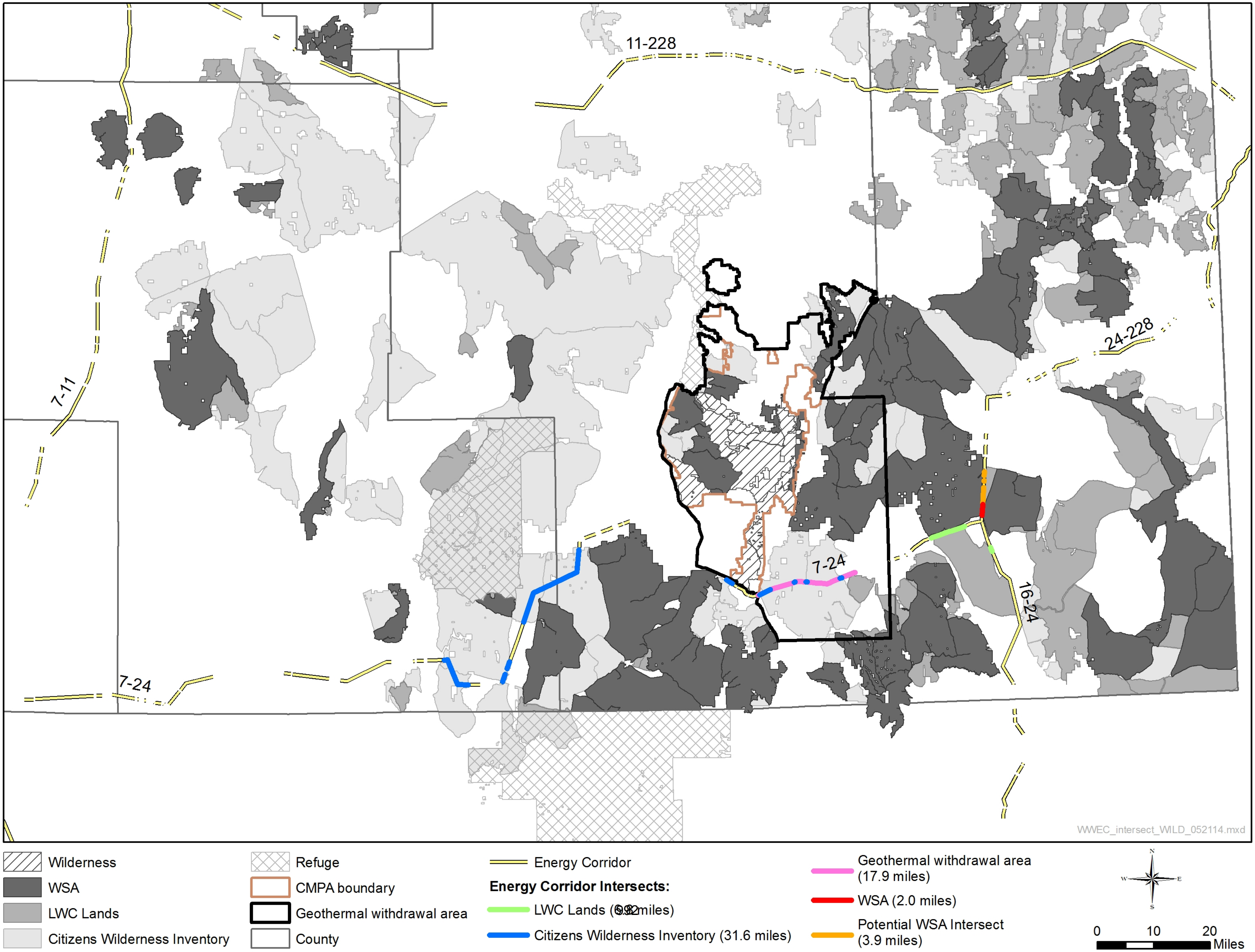


2014 Request for Information
Public Input
Energy Corridors and Historic Route 66
27-225
27-266
27-41
27-41
Nipton
Ivanpah
Cima
Kelso
Crucero
Afton
Hinkley
Yermo
Lenwood
Daggett
Newberry Springs
San Bernardino
Hodge
Helendale
Victorville
Ludlow
Essex
Fenner
Goffs
Needles
Cadiz
Chubbuck
Vidal Junction
Historic Route 66
State Highway
US Highway
Interstate Highway
West-wide Energy Corridors
California BLM Designated Utility Corridors
Land Ownership
Other lands
Bureau of Land Management
National Park Service
Department of Defense
State

2014 Request for Information

WWEC Corridor Intersecting Wilderness Lands

Public Input



2014 Request for Information

WWEC Corridor Intersecting Wilderness Lands

Public Input

WWEC_intersect_WILD_040814.mxd

WSA

Energy Corridor

Corridor through WSA (2.0 miles)

0 2,000 Feet

ALVORD LAKE ROADLESS AREA

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the prior inventory.

The Area:

Approximately 35,722 acres of roadless area lies three miles east of Fields, Oregon. A significant portion of the Alvord Lake Roadless Area was inventoried by BLM as subunit 2-74c as described in the March 1980 and October 1979 editions of the *Wilderness Review Intensive Inventory*. The area is bounded on the south by a powerline and associated road, on the east by the Fields-Folly Farm Road and a combination of public and private lands, on the north by the Alvord Desert WSA, and on the west by a way, private lands, and public lands (NOTE: The area to the east has been further described as the Tule Springs Roadless Area in a separate document).

Wilderness Review Intensive Inventory -March 1980, although noting that the area's "developments are dispersed and substantially unnoticeable" (pg. 46), eliminated the area "from further wilderness review because, although [the area is] generally free of the works of man, [it] does not offer outstanding opportunities for solitude and recreation." (pg. 52) More specifically, the report provides the following reasons for denying the area a WSA designation:

1) Solitude: The report states that within subunit 2-74c, "the only portion of the area where topographic screening is sufficient to allow a feeling of solitude is the southeast corner of the subunit, but this is not outstanding. The remainder of the unit's relatively flat topography and general lack of vegetative screening does not offer an outstanding opportunity for solitude." (pg. 46)

2) Recreation: The report states that subunit 2-74c "offers opportunities for hiking, backpacking, rock climbing, and horseback riding, but the opportunities are not outstanding."

Wilderness characteristics:

1. *Alvord Lake Roadless Area meets the size criterion.*

The Alvord Lake Roadless Area is approximately 35,722 acres in size. The area is encompassed by a road to the south which follows a powerline and road which runs along the southern boundary (see photos A18, A19, A20, and A26) and a road which marks the eastern boundary (see photos A27, A29, A30, A42, A45, and A48). The northeast corner and western edge of the Alvord Lake area is bordered by private land and the northern boundary is formed by a way, referred to in this report as A17a and A17b (see photos A60, A61, A62, and A63). This way separates the Alvord Lake Roadless Area from the existing Alvord WSA.

As described in BLM's new Wilderness Inventory Manual, a "*way*" maintained solely by the passage of vehicles does not constitute a road. If a "way" is used on a regular and continuous basis, it is still not a road. A vehicle route that was constructed by mechanical means *but is no longer being maintained by mechanical methods* is NOT a road. A road, on the other hand, is a vehicle route that has "been improved and maintained by mechanical means to ensure relatively regular and continuous use."

The photos clearly indicate that A17a or A17b cannot be considered a road. Therefore, the Alvord Lake Roadless Area could be considered as an addition to the existing Alvord WSA. In order to allow for the continued access of the private property along the northeast boundary of the Alvord Lake Roadless Area, we propose this area as a separate WSA.

Ways A24, A21c, and A19 also cannot be considered as roads as demonstrated by photos A25, A32, and A58. It is worth noting that way A23 which is illustrated on the “BLM Edition 1989 Alvord Lake, Oregon” map is no longer distinguishable.

2. *Alvord Lake Roadless Area meets naturalness criterion.*

As noted in BLM’s prior wilderness inventory of subunit 2-74c which constitutes the core of the Alvord Lake Roadless Area, “developments are dispersed and are substantially unnoticeable.” (pg. 31) This fact is demonstrated by photos A8, A20, A36, A43, A46, A67.

3. *Alvord Lake Roadless Area provides outstanding opportunities for solitude and primitive recreation.*

As noted above, the Alvord Lake area was disqualified from further consideration as wilderness because “the only portion of the area where topographic screening is sufficient to allow a feeling of solitude is the southeast corner of the subunit, but this is not outstanding. The remainder of the unit’s relatively flat topography and general lack of vegetative screening does not offer an outstanding opportunity for solitude.” (pg. 46)

BLM’s new Wilderness Inventory Handbook provides explicit direction on the correlation of solitude and screening by stating that one should “not assume that simply because an area or portion of an area is flat and/or unvegetated, it automatically lacks an outstanding opportunity for solitude. (pg 14) Furthermore, the manual states that an area need not contain outstanding opportunities for primitive recreation and solitude as the two might be mutually exclusive. The manual states that “the outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Also, an area may be so attractive for recreation use that it would be difficult to maintain opportunity for solitude.” (pg 13)

This Alvord Lake Roadless Area, spanning over 35,722 acres, contains outstanding opportunities for solitude due to its considerable size and broad configuration (nearly 36 square miles) as well as topography and vegetative screening (refer to photos A20, A36, A46, A47, A55, and A67). Contradicting BLM’s prior rationale is the fact that the premier opportunities for solitude in the Alvord Lake area occur in the flattest, most open areas which provide spectacular views of the surrounding Pueblo Mountains, Trout Creek Mountains, Sheepsheads Mountains, and Steens Mountain. Ironically, BLM provided this rationale for the nearby Alvord WSA while maintaining that subunit 2-74c did not contain similar opportunities due to lack of vegetative screening and topography.

The manual defines solitude as “the state of being along or remote from others; isolation. A lonely or secluded place” and outstanding as “standing out among others of kind, conspicuous; prominent. Superior to others of its kind; distinguished; excellent.” (pg. 13) Without question, the Alvord Lake Roadless Area stands among a select few, if not alone, as one of our nation’s distinguished places for seclusion or isolation.

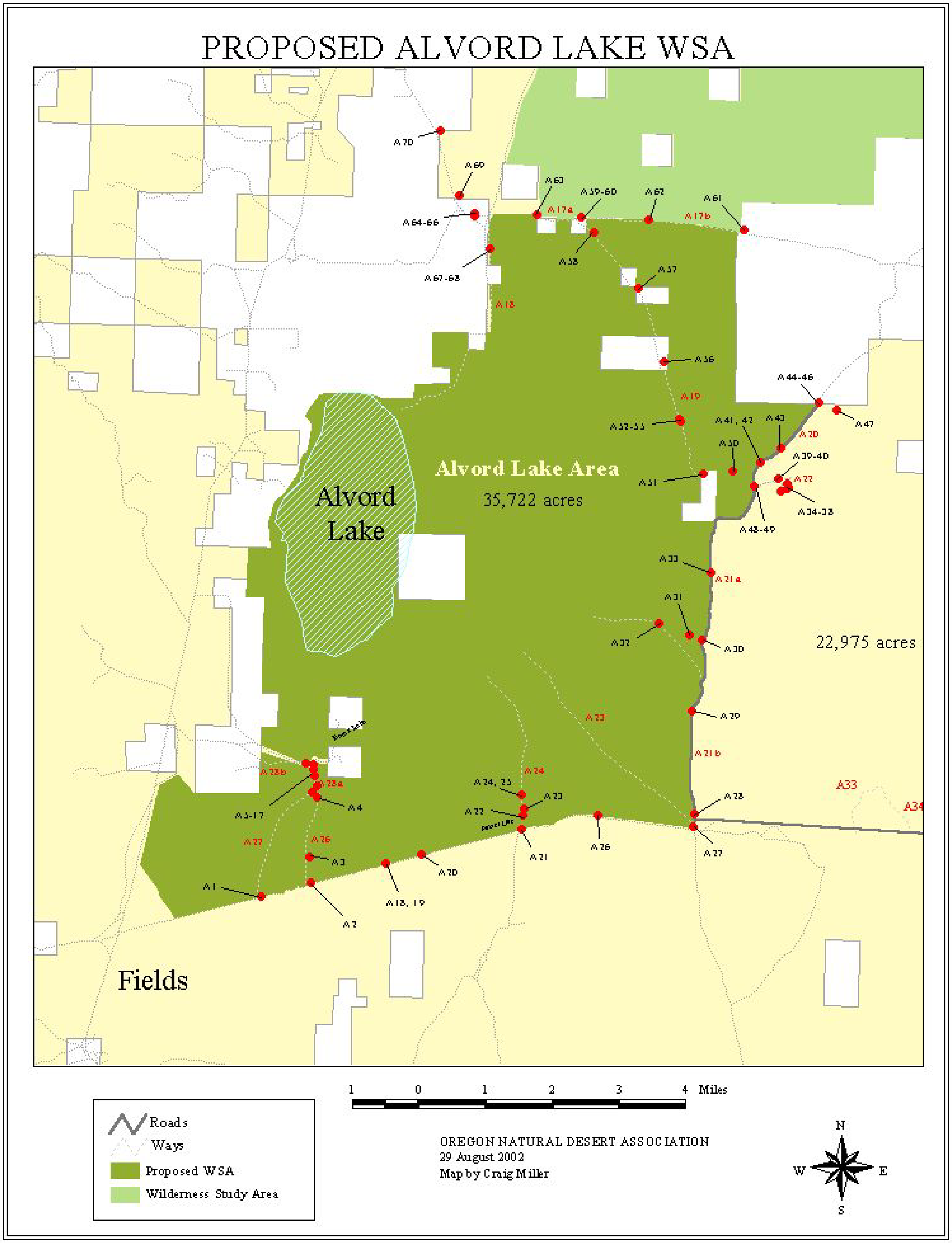
In addition, the Alvord Lake Roadless area provides outstanding opportunities for primitive recreation including hiking, backpacking, horseback riding, rockhounding, bouldering, rock climbing, birding (A9), photography, herpetology (photos A17, A52, A53, and A54), geology, and hunting. The sand dunes, playas, and cliffs provide unique opportunities for naturalists to research species of arachnids and reptiles which are rare or uncommon in Oregon. In addition, the several caves located on the eastern edge of the area provide opportunities for archaeological study.

4. *Alvord Lake Roadless Area has supplemental values.*

BLM's March 1980 edition of the *Wilderness Review Intensive* Inventory states that "the sand dunes which cover much of the subunit provide a great diversity of plant and animal life, and are therefore of environmental and educational interest. The area, because of its terrain, allows for broad vistas of the surrounding mountain ranges (Steens Mountain and the Pueblo Mountains)." (pg. 46) In addition, the area contains a Wild Horse Herd Management Area, Pronghorn Winter Range, Bighorn Sheep Habitat, and a Research Natural Area for Great Basin Wild Rye.

NEW Information:

This area was not recommended for WSA designation due to BLM's prior determination that the area did not contain outstanding opportunities for primitive recreation and solitude. We have documented that the Alvord Lake Roadless Area meets the size and naturalness criteria and offers outstanding opportunities for solitude and for primitive recreation as well as supplemental values. This area should be designated as a Wilderness Study Area.


PROPOSED ALVORD LAKE WSA
Alvord Lake Area
35,722 acres
Alvord Lake
22,975 acres
Fields
A33
A34
1 0 1 2 3 4 Miles
Roads
Ways
Proposed WSA
Wilderness Study Area
OREGON NATURAL DESERT ASSOCIATION
29 August 2002
Map by Craig Miller
N
W
E
S

BABES CANYON ROADLESS AREA

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the prior inventory.

The Area:

Approximately 13,041 acres south of the Steens Mountain Wilderness and west of Fields.

The area is bounded on the north by the Long Hollow Road (Highway 208), on the south by private land (old McDade Ranch) and a road which follows Williams Creek.

BLM wilderness inventory subunits 2-82C, 2-82G, and a portion of the Rincon WSA, form the western boundary.

There are two private inholdings for a total of 129 acres within the roadless area.

The area of interest, identified by BLM as wilderness subunit 2-82D, was eliminated from further wilderness review by BLM because:

> Naturalness: "...the works of man are still substantially noticeably due to the number and placement of ways and fences."
>
> Solitude: "...would not be outstanding due to openness of the area and lack of vegetative screening."
>
> Recreation: "...opportunities are not outstanding."

Wilderness Review-Intensive Inventory, March, 1980, page 59

Wilderness characteristics:

1. *Babes Canyon Roadless Area meets the size criterion.*

The proposed Babes Canyon Roadless Area is approximately 13,041 acres. The road along the west boundary of the proposed area is labeled on the accompanying map as PB4a.

2. *Babes Canyon Roadless Area meets naturalness criterion.*

The Babes Canyon Roadless area appears to be in a generally natural condition with man's imprint substantially unnoticeable. Since BLM's final decision in the March 1980 decision, the subunit appears to be generally free of the works of man. While there are fences and water developments along route PB4a, they represent a small percentage of the area and no longer impact the area's natural qualities (See photos C1-C14 and D 13, 14, 15, 16, 17, and 18)

3. *Babes Canyon Roadless Area provides outstanding opportunities for solitude and primitive recreation.*

The Babes Canyon Roadless area offers outstanding opportunities for solitude because of its size (13,041 acres), configuration (4 miles across), and undulating topography and relief.

As previously noted, Babes Canyon was dropped from consideration by BLM in part because of an absence of vegetative screening. BLM's new *Wilderness Inventory and Study Procedures Handbook (H-6310-1)* provides explicit guidance on the relationship between solitude and vegetative screening stating that one should "not assume that simply because an area or portion of an area is flat and/or unvegetated, it automatically lacks an outstanding opportunity for solitude. (pg 14) Regardless of vegetation screening, there is extensive topographic screening as can be seen in the photos.

Corroborating our assessment, Congress recently designated the Steens Wilderness immediately north of Babes Canyon, across the Long Hollow Road, an area that shares many of the physical characteristics with Babes Canyon. Further underscoring the uniform nature of the landscape, photos C3,6,8 and 9 on route PB4a border the Rincon WSA.

Babes Canyon Roadless Area contains outstanding opportunities for solitude due to its size, as well as its rolling topography, which contributes to the opportunity for solitude. The open areas with sloping topography provide one with an expansive sense of solitude and spectacular vistas.

BLM's Wilderness Manual states that an area need not contain outstanding opportunities for primitive recreation and solitude as the two might be mutually exclusive. The manual states that "the outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Also, an area may be so attractive for recreation use that it would be difficult to maintain opportunity for solitude." (pg 13)

Babes Canyon Roadless Area provides outstanding opportunities for hunting, hiking, camping, backpacking, horseback riding, rockhounding, photography, wildlife viewing (photo D14) and geology.

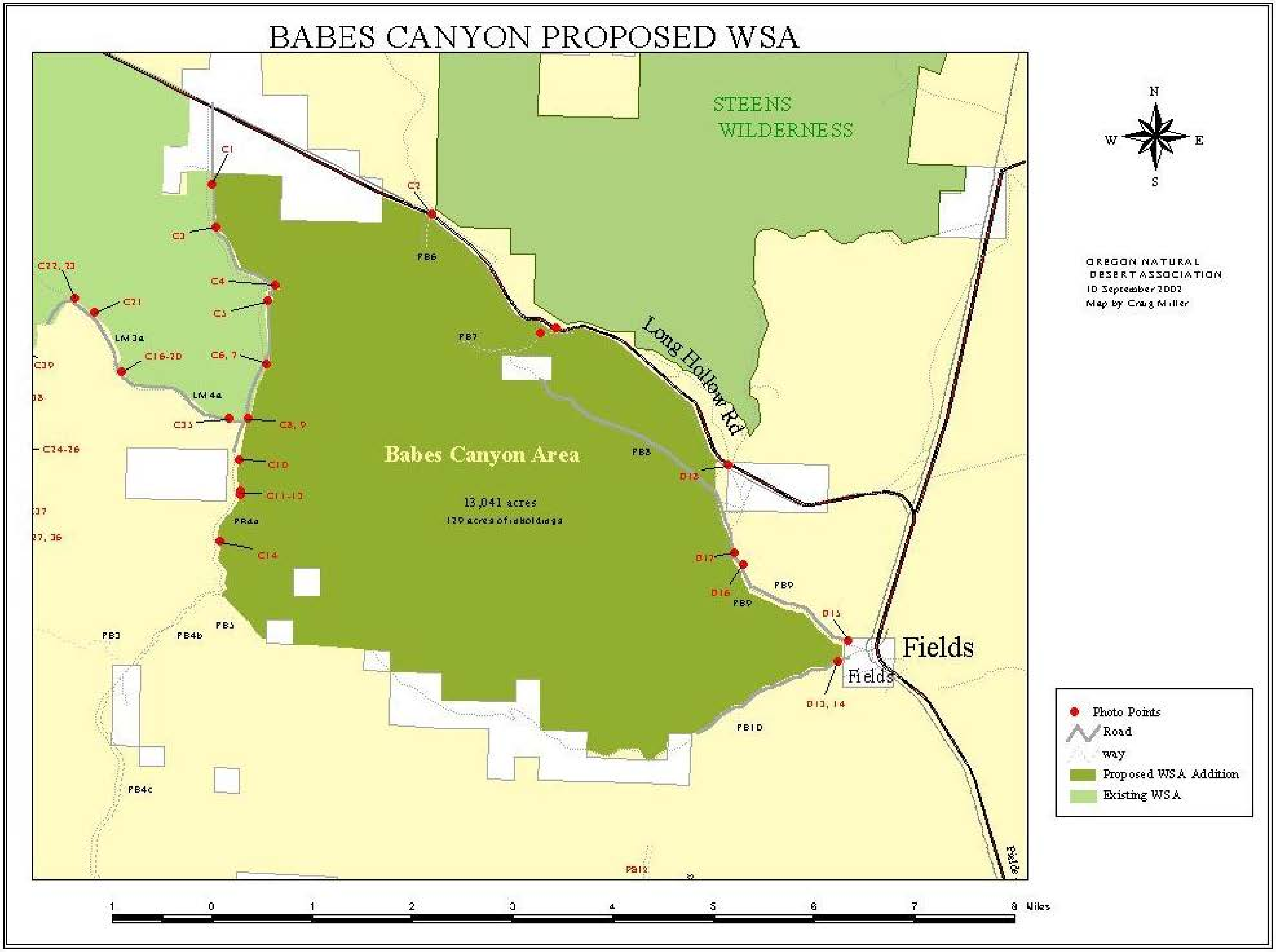
In particular, we note that Babes Canyon is the logical southerly extension for hikers and horseback riders of the newly created Steens Mountain Wilderness.

4. Babes Canyon Roadless Area *has supplemental values.*

In 1980, BLM incorrectly stated there were no known supplemental values within this area (pg. 59). In fact, BLM did not document the spectacular views of Alvord Peak (in the Steens Mountain Wilderness), Pueblo Mountain, Trout Creek Mountains, Alvord Desert, and Pueblo Valley. These unique vistas provide excellent opportunities for photography and are considered a supplemental value. Since the original inventory, portions of this area have been identified as Pronghorn Winter Range and Sage grouse habitat.

NEW Information:

This area was not recommended for WSA status due to BLM's prior determination that the area did not have natural values or contain outstanding opportunities for primitive recreation and solitude. We have documented that the Babes Canyon Roadless Area has these criteria along with supplemental values and recommend Babes Canyon Roadless Area be designated a Wilderness Study Area.


BABES CANYON PROPOSED WSA
STEENS
WILDERNESS
Long Hollow Rd
Babes Canyon Area
13,041 acres
Fields
Fields
N
W
E
S
OREGON NATURAL
DESERT ASSOCIATION
10 September 2002
Map by Craig Miller
Photo Points
Road
way
Proposed WSA Addition
Existing WSA
C1
C2
C3
C4
C5
C6, 7
C8, 9
C10
C11-13
C14
C21
C22, 23
C16-20
C33
C24-26
C39
PB3
PB4b
PB4c
PB5
PB6
PB7
PB8
PB9
PB10
PB12
D12
D13, 14
D15
D16
D17
LM 3a
LM 4a
1
0
1
2
3
4
5
6
7
8 Miles

BLACK POINT ROADLESS AREA

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the prior inventory.

The Area:

Black Point contains approximately 81,454 acres of roadless area, lies due east of Fields, and contains previously inventoried subunits 2-75A, 2-75B, 2-75C, 2-75D, 2-75E, 2-75F, and 2-74M. This area is bounded on the north by a transmission line, on the south and east by private property and Whitehorse Ranch Road, and on the west by a transmission line. The area contains four inholdings totaling 2372 acres.

In 1980 this area was not recommended for WSA designation. When the original inventory was conducted, BLM segmented the area into multiple subunits on the basis of "BLM roads." However, we provide documentation that these paths can no longer be considered roads using BLM's guidelines. As a consequence, arguments used to exclude WSA status for "subunits" are not valid when considering the unit as a whole, especially when exclusion was on the basis of a lack of outstanding opportunities for solitude and lack of natural appearance. We will demonstrate that the Black Point area meets all criteria for wilderness status and should therefore be designated a Wilderness Study Area.

Wilderness characteristics:

1. *Black Point Roadless Area meets the size criterion.*

The Black Point Roadless Area is about 81,454 acres in size, far in excess of the minimum size criterion of 5000 acres. Several "subunits" (e.g. 2-75B, 2-75D, 2-75E, and 2-75F) were excluded without consideration because they did not meet the minimum size criterion. However, these "subunits" are at present arbitrary because they are not separated by roads. A road is a vehicle route that has "been improved and maintained by mechanical means to ensure relatively regular and continuous use." A vehicle route that was constructed by mechanical means *but is no longer being maintained by mechanical methods* is NOT a "road."

Photos A47-49 show the "way" that separates Unit 2-75F from Unit 2-75A. This way is clearly *not* maintained to ensure relatively regular and continuous use; it is in poor condition, in places barely visible, and in many places overgrown with shrubs. If mechanical means were ever used to construct this way, it is not apparent.

Photos A39, A42, A46, A45, A53 and 56 show the "way" that separates Unit 2-75B from Units 2-75A and 2-75F. Although this way is in fairly good condition in places, there are other places where it is overgrown with vegetation and weathered. There is no indication that it has been maintained by mechanical means for regular or continuous use, nor does it appear that it has ever been bladed, or otherwise maintained or constructed by mechanical means. Although the north end of the way labeled BP5 does appear to have been bladed, and additionally appears to receive a use annually, the more southerly stretch does not appear to be maintained or to have been contructed by mechanical means (photos A60, A61). Therefore subunit 2-75A and 1-75C are contiguous.

Photos A35 and A55 show the northern and southern ends of the way that separates subunit 2-75B and 2-75D from 2-75C, and labeled on the map as BP7a. This clearly is not a road, appears never to have been constructed or maintained by mechanical means, is not maintained to receive regular or continuous use, and is overgrown with vegetation.

Subunit 2-75D is bounded by ways that clearly are not (nor appear to have been) maintained for regular or continuous use (photos A35, A37, A41). It is possible that the nw boundary may not even qualify as a "way" (photo A41). Therefore subunit 2-75D is contiguous with subunits 2-75B, 2-75C, and 2-75E. The way that separates subunit 2-75F and 2-75E is shown in photos A33, A34, and A36. While not in bad condition, there appears to be no past or present maintenance by mechanical means for regular or continuous use; this is not a road.

Subunit C appears to have had a water line constructed since the original inventory was conducted along a way labeled BP24 on the map we have provided. Although the way and water line were constructed using mechanical means, the track is no longer maintained, and is therefore a way and not a road (photos A24, A26, A27, and A28). Any other subunits that may be included in the Black Point Roadless Area shown on the map but not mentioned above are not separated by roads (and are therefore contiguous) as documented by the accompanying photographs.

The original Black Point Unit (2-75) inventory was not considered in conjunction with 2-74M with which it is contiguous. The tracks separating these units and subunits are not roads as documented in the photos provided (A68, A69, A70, A72, A73, A74, A76, A77). Even though each of these subunits meet the size criterion on their own, we have documented that all these areas qualify as one continuous unit, and separation into units and subunits is at present arbitrary.

2. *The Black Point Roadless Area meets naturalness criterion.*

The most noticeable imprint of man is the presence of the radio facility located at the top of Buckskin Mountain (Lookout Butte). There is a non-maintained way and a transmission line that leads from the east boundary to the radio facility (A98, A100, A101, A105). Other imprints of man that are mentioned in the original inventory for subunits in the area include crested wheatgrass seedings, fencelines, wells, spring developments, reservoirs, wildlife guzzlers, herbicide spraying, and "fenceline vegetation differences". However, the Wilderness Inventory and study Procedures H-6310-1 (1-10-2001) gives examples of man-made features that may be substantially unnoticeable including wildlife enhancement facilities, radio repeater sites, fencing, spring developments, and small reservoirs.

The *Wilderness Inventory and Study Procedures* H-6310-1 (1-10-2001) also has the following to say about "Naturalness" on page 12. "There is an important difference between an area's natural integrity and its apparent naturalness. Natural integrity refers to the presence of absence of ecosystems that are relatively unaffected by human's activities. Apparent naturalness refers to whether or not an area looks natural to the average visitor who is not familiar with the biological presence or absence of naturalness (i.e. do the works of humans appear to be substantially unnoticeable to the average visitor") is the question the Wilderness Act directs the review to assess." Although crested wheatgrass seedings (and "fenceline vegetation differences") may not imbue natural integrity, the average visitor who is not familiar with such vegetation is unlikely to conclude that its presence is a result of the activities of humans. Wheatgrass seedings will revert to native vegetation in time, and is no longer considered a valid reason to exclude an area from WSA status.

A number of stock tanks and wells have been installed throughout the area, but are generally visible only at close proximity, and does not significantly affect the overall naturalness of the area (A75, A76). One marginally maintained road occurs at the south-east portion of the Black Point Area, and forks, both branches of which eventually peter out to become ways (A68, A69, A70, A72, A73, A74, A76, A77-95). A power substation, airstrip, landfill, and irrigation ditches noted in the original inventory as occurring on the eastern portion of subunit 2-75A are east of the transmission line that forms the west boundary of the Black Point Area, and therefore are not within the area we are considering.

When we consider the area in question as a whole, man's imprints are not substantially noticeable, and overall there is an appearance of naturalness (A1, A9, A12, A13, A15-18, A25, A31, A43, A51, A52, A54, A67, A71, A79, A96, A108, A115, and B3,)

3. *Black Point Roadless Area provides outstanding opportunities for solitude and primitive recreation.*

The size and configuration of the Black Point area (more than 80,000 acres) ensures outstanding opportunities for solitude. This would be true even if the land was flat and there was no vegetation. However, the terrain over this area is varied, and in places rugged. Although the original inventory for subunit 2-75A stated that "the lack of topographic or vegetative screening within this area prevents the subunit from offering outstanding opportunities for solitude," conditions are now such that vegetative screening is sufficient to provide outstanding opportunities for solitude in this portion of the unit (Photos A5, A6, A8, A9, A11-14). Although the original inventory for subunit 2-75C stated that "the gently rolling topography which comprises the majority of this subunit, the broad sloping nature of the ridges, and the vegetative cover do not offer outstanding opportunities for solitude," photos A12, A15, A16, A18, A24, A25, A27, A62, A63, A66, A43, A51, and A53-55 indicate otherwise. Rugged country, varied terrain, and 300 ft. high cliffs provide incredible opportunities for solitude in this 28,000 acre portion of the unit! When I (Craig Miller) visited this area over Labor Day weekend, I did not see another person, and I experienced a profound sense of solitude. The part of the unit consisting of subunit 2-74M also contains outstanding opportunities for solitude as stated in the original inventory.

In addition outstanding opportunities for primitive recreation may be found within the area as noted in the original inventory. Those opportunities mentioned as outstanding include hiking, backpacking, horseback riding, sightseeing, rock climbing, and rockhounding. As mentioned, "the area provides a degree of challenge, risk and scenery which would make the opportunities for these activities outstanding." Additional outstanding opportunities for the area include photography, wildlife viewing, herpetology, geology, and camping (photos A12, A13, A15-18, A25, A43, A44, A51, A54, A71, A96, A107, and A108).

4. *Black Point Roadless Area has supplemental values.*

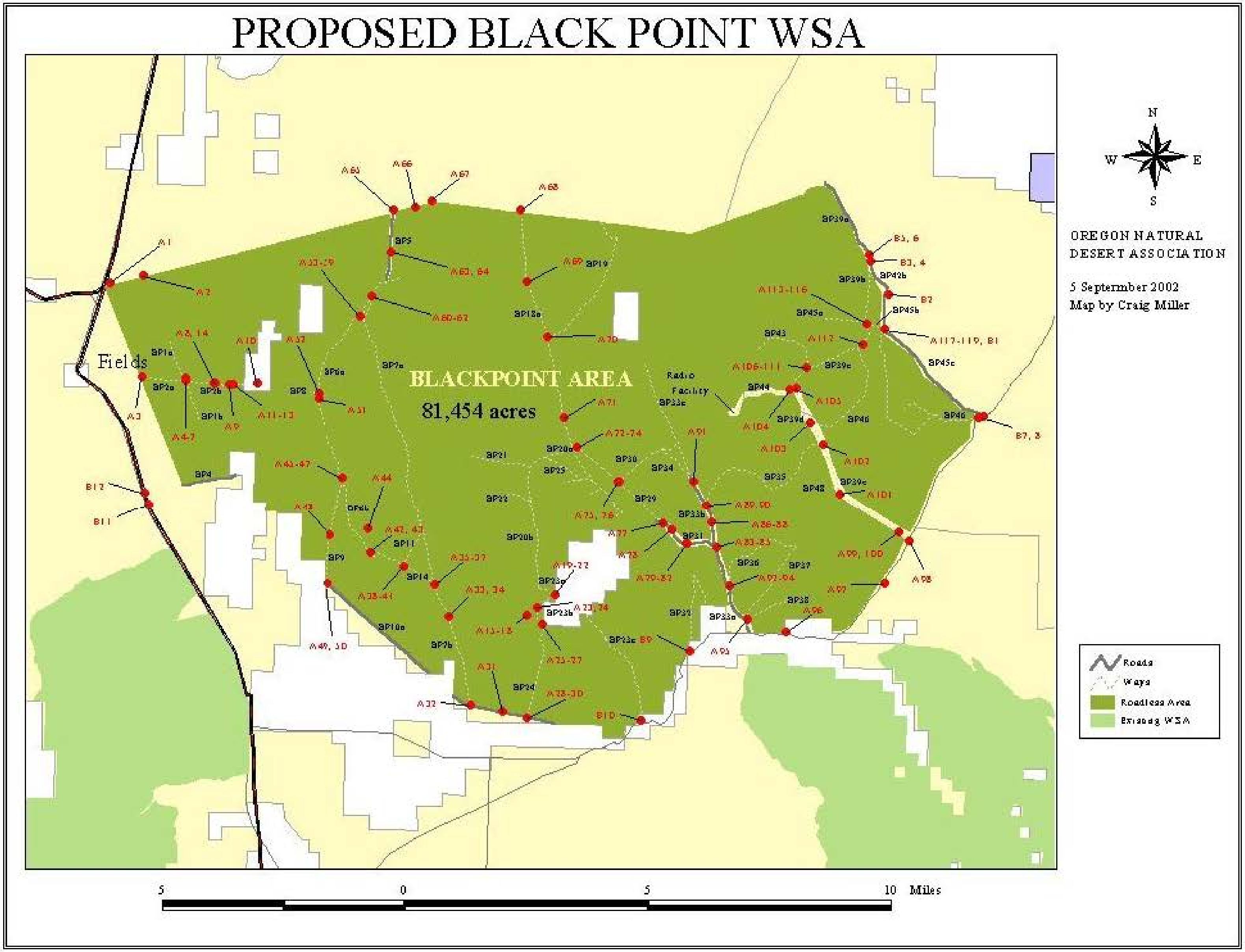
Supplemental values already noted in the original inventory include: sand dunes that contain a variety of plants and animals, cultural resource values, and the presence of cacti. Additional values not mentioned include cliffs that provide nesting for Golden Eagles, habitat amenable to Sage Sparrows and Black-throated Sparrows, and opportunities to view wild horses (see photos A63, A64, A57-59).

NEW Information:

The multiple subunits into which this area was segmented were not recommended for WSA designation, primarily because they were considered in a piecemeal fashion rather than a contiguous 80,000+ acre block, but also because the rationale included items that are no longer valid. When considering the area as a whole, this large parcel meets all criteria for inclusion as a Wilderness Study Area. Several subunits were discarded as being too small, but we have documented that these subunits are now arbitrary, because they are bounded by ways, not roads. These subunits include 2-75B, 2-75D, 2-75E, and 2-75F. We have documented all pertinent roads and ways within the Black Point area and we are providing the photographs along with a map that shows the extent of roads and ways. We have documented that the proposed Black Point unit is not divided by “roads” as defined under BLM guidelines.

Area 2-75A was excluded on the basis of lack of vegetative cover, but we have documented that there is sufficient vegetative screening to provide outstanding opportunities for solitude in this portion of the unit. Area 2-75C was excluded on the basis of a lack of topographic screening, but we have provided documentation that there is sufficient topographic screening to provide outstanding opportunities for solitude in this portion of the area as well.

We have documented that the Black Point area meets the size and naturalness criteria, and offers outstanding opportunities for solitude and for primitive recreation as well as supplemental values. This area should be designated as a Wilderness Study Area and added to the existing Pueblo Mountains Wilderness Study Area.


PROPOSED BLACK POINT WSA
BLACKPOINT AREA
81,454 acres
Fields
N
W
E
S
OREGON NATURAL
DESERT ASSOCIATION
5 September 2002
Map by Craig Miller
Roads
Ways
Roadless Area
Existing WSA
5
0
5
10
Miles

Coleman Rim proposed WSA

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the BLM's prior inventory.

The area:

The Coleman Rim proposed WSA totals approximately 35,985 acres and is bordered on the south by road CR-SN, on the west by road 1121-1126 and 1126m, on the east by road CR-1126, and on the north by highway 140.

The Coleman Rim proposed WSA consists of the following units:

- 1-126/CA-020-1010, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the works of man were substantially noticeable in the northern part of the unit, while the unit overall did not offer outstanding opportunities for solitude and primitive and unconfined recreation.

The information provided in this report will demonstrate that each of the preceding rationale is no longer accurate or applicable and demonstrate that Coleman Rim proposed WSA does in fact meet wilderness criteria.

Wilderness characteristics:

I. *Coleman Rim proposed WSA meets the minimum size criteria, and the units within are contiguous with each other.*

The Coleman Rim proposed WSA totals approximately 35,985 acres and is bordered on the south by road CR-SN, on the west by road 1121-1126 and 1126m, on the east by road CR-1126, and on the north by highway 140. Within this area, there are no roads.

BLM's wilderness policy states that a "way" maintained solely by the passage of vehicles does not constitute a road. If a "way" is used on a regular and continuous basis, it is still not a road. A vehicle route that was constructed by mechanical means *but is no longer being maintained by mechanical methods* is NOT a road. A road, by comparison, is a vehicle route that has "been improved and maintained by mechanical means to ensure relatively regular and continuous use."

Coleman Rim proposed WSA contains routes 1126a, 1126b, 1126b1, 1126c, 1126d, 1126g, 1126j, 1126k, 1126k1, 1126k2, 1126k3, 1126L, 1126n, 1126p, and 1121j. Although this appears to be many routes, several of these are less than 2 miles long, while others were so overgrown they were hard to find. 1126a is an unmaintained way (photo EJ 45). 1126b is an unmaintained, overgrown way (photos EJ 4, 5). 1126b1 is an unmaintained, overgrown way (photo EJ 2). 1126c is an unmaintained, overgrown way (photos EJ 3, 9). 1126d is an unmaintained, rutted way (photo EJ 53). 1126g is an unmaintained, overgrown way (photo EJ 12). 1126j is an unmaintained way (photo EJ 15). 1126k is an unmaintained, overgrown, rarely used way (photo EQ 4). 1126k1 is an unmaintained, impassable way (photo EJ 32). 1126k2 is an unmaintained, rocky way (photo EJ 33). 1126k3 is an unmaintained way (photo EJ 34). 1126L is an unmaintained way (photo EQ 5). 1126n is an unmaintained, overgrown way (photo EQ 13). 1126p is an unmaintained, partially overgrown way (photo EQ 10). 1121j is an unmaintained, rutted way (photo EJ 50).

Because these ways are not being maintained by mechanical means to ensure regular and continuous use, Coleman Rim proposed WSA is a roadless area.

II. *Coleman Rim proposed WSA is primarily affected by the forces of nature.*

The BLM noted in their inventory that the northern end of unit 1-126/CA-020-1010 did not appear in a natural condition, while the southern portion appeared to be primarily affected by the forces of nature.

BLM noted that the northern part of unit 1-126/CA-020-1010 did not appear generally natural because of 26 miles of ways. This inventory found that these ways did not have a significant impact on the naturalness of the area. They are becoming overgrown and do not have a substantial impact on the landscape (see Section I). Furthermore, the broken terrain and rolling hills of Coleman Rim prevents visitors from noticing these ways (photos EJ 2, 3, 9, 15, 45, 50, 53). Therefore, the ways in the northern part of Coleman Rim proposed WSA do not have a cumulative impact on the area making the entirety of the area appear primarily affected by the forces of nature (photos EJ 2, 3, 9, 15, 45, 50, 53 (background); EQ 1, 2, 3, 6, 7, 8, 9).

III. *Coleman Rim proposed WSA provides outstanding opportunities for solitude and primitive recreation.*

BLM noted during the initial inventory that Unit 1-126/CA-020-1010 was eliminated from further review because the eastern part of the unit consisted of rolling to flat terrain that did not offer outstanding opportunities for solitude and primitive and unconfined recreation. However, BLM also mentioned that the rim on the western portion of the unit and a small side canyon, which breaks the rim just south of the Nevada border, would offer some opportunity for solitude and hiking.

Because unit 1-126/CA-020-1010 consists of a wide array of topography, BLM's original assessment is not accurate. Coleman Rim readily offers outstanding opportunities in solitude and primitive and unconfined recreation. Visitors can easily experience an outstanding sense solitude in the canyons, along the top of the rim, or in the rolling hills (photos EJ 3, 9, 45, 50, 53 (background); EQ 1, 2, 3, 6, 7, 8). Furthermore, juniper can be found in areas of the proposed WSA, which further adds to an outstanding sense of solitude (photos EJ 2, 15; EQ 9) because of the screening they provide. The canyons, Coleman Rim, and the rolling hills offers outstanding opportunities for hikers, sightseers, backpackers, and horseback riders. The junipers, sagebrush, and native bunchgrasses provides outstanding wildlife habitat. This habitat makes wildlife viewing and hunting outstanding within the proposed WSA. Even the ways that run through the eastern portion of the unit are great access routes to the proposed WSA and can be enjoyed by horseback riders and hikers.

Because of these reasons, it is easy to see that Coleman Rim proposed WSA offers outstanding opportunities in solitude and primitive and unconfined recreation.

IX. *Coleman Rim proposed WSA has supplemental values that would enhance the wilderness experience and should receive wilderness protection.*

Coleman Rim proposed WSA contains the Spanish Lakes RNA, which has botanical and wildlife values. The Lakeview RMP FEIS mentioned that the Spanish Lakes RNA contains a, "Diversity of salt desert scrub communities with limited distribution in LRA and Northern Great Basin" Pg 2-58. The BLM also noted during their inventory that the area has some archeological value.

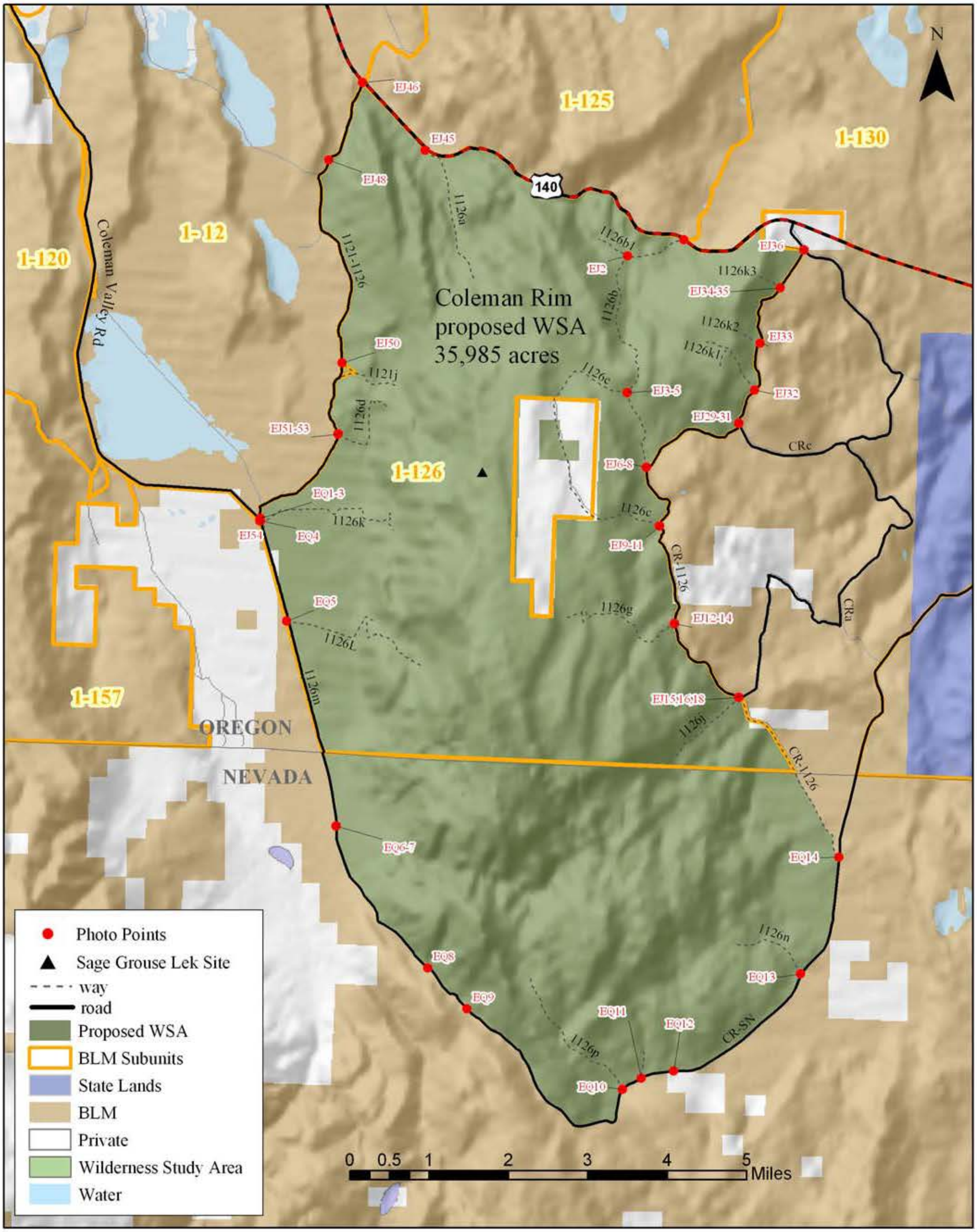
The Greater Sage Grouse is a species of concern throughout its range with a population that is on a significant downward trend. Habitat fragmentation is one of the primary causes of this decline. The Coleman Rim proposed WSA provides prime habitat for this species as it is home to at least one known Sage Grouse Leks (see map). This area may be home to the Pygmy Rabbit, California Bighorn Sheep, Burrowing Owl, and Peregrine Falcon, which are Federal Species of Concern.

Summary:

This area was not recommended for WSA designation based on the original determination that part of the unit did not appear in a natural condition, while all of it did not offer outstanding opportunities for solitude or a primitive and unconfined type of recreation. Because this area offers diverse terrain, including the grandiose Coleman Rim, and because many changes have occurred to the landscape since BLM's original inventory in the late 1970's, these original determinations have to be amended.

We have provided new information, including geo-referenced digital images, documenting that the proposed Coleman Rim WSA meets wilderness criteria. The proposed WSA is roadless, is in an apparently natural condition, contains outstanding opportunities for solitude and recreation, and possesses supplemental values. This area deserves to be designated as a Wilderness Study Area.

Coleman Rim proposed WSA



Hart Mountain proposed WSA

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the BLM's prior inventory.

The area:

The Hart Mountain proposed WSA totals approximately 424,570 acres and is bordered on the south by highway 140, on the east by Beatys Butte Road and private property, on the west by Hart Lake and unit 1-122 (which did not meet wilderness characteristics), and on the north by the road to Frenchglen (BN-PN on our map).

This is a multi-agency proposal involving both BLM and the U.S. Fish and Wildlife Service. A large portion of this proposal consists of Hart Mountain National Antelope Refuge, which has not been inventoried for wilderness characteristics and qualities. All information presented in this report is new and pertinent.

The Hart Mountain proposed WSA also consists of the following BLM units:

- 1-115, which was divided into two subunits, 1-115a and 1-115b, in BLM's November, 1980 *Final Intensive Inventory Decisions*. Both subunits were eliminated because they did not have outstanding opportunities for solitude or primitive and unconfined recreation.
- 1-123, which was eliminated from further wilderness review in BLM's April, 1979 *Wilderness Proposed Initial Inventory* because the area did not appear natural.
- 1-124, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the size and shape of the unit did not offer outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-125, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area appeared unnatural, while opportunities for solitude or recreation were not outstanding.
- 1-127, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area appeared unnatural, while the units shape and size did not allow for outstanding opportunities for solitude or primitive and unconfined recreation.
- 1-128, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area appeared unnatural, while the narrow shape and size did not allow outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-129, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because they are appears unnatural, while the small size and narrow shape did not allow for outstanding opportunities in solitude or primitive and unconfined recreation.

- 1-130, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area does not appear natural, while the area did not have outstanding opportunities for solitude or primitive and unconfined recreation
- 1-132, which is Guano Creek WSA and was recommended for wilderness designation by BLM in their October, 1991 *Wilderness Study Report.*
- 1-131, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area did not offer outstanding opportunities in solitude or primitive and unconfined forms of recreation.
- 1-133, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area did not offer outstanding opportunities in solitude or primitive and unconfined forms of recreation.
- 1-134, which was eliminated from further wilderness review in BLM's November, 1980 *Final Intensive Inventory Decisions* because the area did not offer outstanding opportunities in solitude or primitive and unconfined forms of recreation.
- An unknown unit to the south of 1-128, which has not been previously inventoried. All information presented here is new and pertinent.

This report will demonstrate that Hart Mountain proposed WSA does in fact meet wilderness criteria.

Wilderness characteristics:

I. *Hart Mountain proposed WSA meets the minimum size criteria, and the units within are contiguous with each other.*

The Hart Mountain proposed WSA totals approximately 424,570 acres and is bordered on the south by highway 140, on the east by Beatys Butte Road and private property, on the west by Hart Lake and unit 1-122 (which did not meet wilderness characteristics), and on the north by the road to Frenchglen (BN-PN on our map). Within this area, there are no roads that bisect the area.

BLM's wilderness policy states that a "way" maintained solely by the passage of vehicles does not constitute a road. If a "way" is used on a regular and continuous basis, it is still not a road. A vehicle route that was constructed by mechanical means *but is no longer being maintained by mechanical methods* is NOT a road. A road, by comparison, is a vehicle route that has "been improved and maintained by mechanical means to ensure relatively regular and continuous use."

Unit 1-130 was separated from unit 1-125, an unknown unit north of 1-125, 1-128, 1-129, and 1-133 by routes 1125-1130, 1128-1130, 1129-1130, and 1130-1133, respectively. 1125-1130 appears to have been maintained in the past, but it hasn't been maintained recently making it is an unmaintained, rocky way (photos DV 1, 5). This route eventually turns into 1128-1130, which is an unmaintained, rocky way (photo DV 7, 10, 11). 1129-1130 is an unmaintained, rocky, way (photo DV 14), which becomes so overgrown it is nearly imperceptible (photo DV 22). 1130-1133 is an unmaintained, rocky, rutted way (photo DV 21, 50). Unit 1-130 also contains routes 1130b. 1130b is an unmaintained, rocky, rutted, overgrown, nearly impassable way (photos DV 4, 12). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-133 is contiguous with units 1-125, an unknown unit north of 1-125, 1-128, 1-129, and 1-133, and it is a roadless area.

Unit 1-133 was separated from unit 1-129 and Guano Creek WSA by routes 1129-1133 and 132-133, respectively. 1129-1133 is an unmaintained, rocky, overgrown way (photos DV 20, 33). 132-133 is an unmaintained, rocky, rutted, washed out way (photos DV 36-39, 46). Unit 1-133 also contains routes 1133a and 1133b. 1133a is an unmaintained, rocky way (photo DV 42). 1133b is an unmaintained, overgrown way (DV 45). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-130 is contiguous with unit 1-129, Guano Creek WSA, and 1-133 (see above), and it is a roadless area.

Unit 1-129 was separated from Guano Creek WSA and 1-128 by routes 129-132 and 1128-1129, respectively. 129-132 appears to have been bladed at one time, but it has since deteriorated into an unmaintained, rocky, overgrown way (photo DV 31). 1128-1129 is an unmaintained, rocky, washed out, overgrown, nearly impassable way (photo DV 13, EL 39, 40, 44, 45). Unit 1-129 also contains routes 1129c, 1129d, and 1129e. 1129c is an unmaintained, overgrown way (photo DV 16). 1129d is an unmaintained, overgrown way (photo DV 17). 1129e appears to be an access to a reservoir (photo DV 27). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-129 is contiguous with Guano Creek WSA, unit 1-128, and unit 1-130 (see above), and it is roadless.

Guano Creek WSA, or unit 1-132, was separated from unit 1-131 by PS-1132. This is an unmaintained, rutted way (photo DT 39). Because this way is not being maintained by mechanical means to ensure regular and continuous use, unit Guano Creek WSA is contiguous with units 1-131 and 1-133 (see above), and it is roadless.

Unit 1-131 was not separated from Hart Mountain National Antelope Refuge by a hard boundary. Actually, it appears this boundary is purely subjective. Unit 1-131 only contains one way, PSt. This is a way because the only access to it was from PSt and PSu, which are unmaintained, overgrown ways (photos DN 49, 51, respectively). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-131 is contiguous with Hart Mountain National Antelope Refuge and Guano Creek WSA, and it is roadless.

Unit 1-128 was separated from the unknown unit by route ML-1128. ML-1128 is an unmaintained, rocky way as it runs north from the private property (photos EL 27, 28, 29, 33, 35), while it is a nearly impassable way running east from the private property (photos EL 46, 47, 48, 50). Unit 1-128 also contains route 128a. 128a is an unmaintained, overgrown way (photo EL 30). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-128 is contiguous with units 1-129 (see above) and the unknown unit, and it is roadless.

The unknown unit was separated from unit 1-124, 1-125, and 1-127 by ML-1124, ML-1125, and BS-ML, respectively. ML-1124 is a road when it comes off of 1123-1125 (photo EL 2), but it becomes an unmaintained, overgrown, extremely rocky way after it passes the reservoirs (photos EL 10, 14). ML-1125 is also a road as it comes off of 1123-1125 (photo EL 3), but soon becomes an unmaintained, overgrown, nearly impassable way (photo EL 19, 22; DV 6). BS-ML is an unmaintained, extremely rocky way (photos EH 18, 20, 22). The unknown unit also contains routes MLa and MLc. MLa, even though it is labeled as a BLM road, is an unmaintained, rocky way (photo EL 34). MLc is so rocky that it is impassable (photo EL 8). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, the unknown unit is contiguous with units 1-124, 1-125, 1-127 and 1-128 (see above), and it is roadless.

Unit 1-124 was separated from unit 1-123 and 1-127 by 1123-1124 and BS-1124, respectively. 1123-1124 is an unmaintained, rocky, rutted way (photos EH 32, 36). BS-1124 is an unmaintained, extremely rocky way (photos EH 10, 11, 12, 13). Unit 1-124 also contains routes 1124b and 1124c. 1124b is an unmaintained, overgrown way (photo EH 6). 1124c is an unmaintained, overgrown, barely discernable way (photo EL 15). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-124 is contiguous with units 1-123, 1-127, and the unknown unit (see above), and it is roadless.

Unit 1-125 contains routes 1125a, 1125b, and 1125d. 1125a is an unmaintained, rocky, rutted way (photo EL 16). 1125b is an unmaintained, overgrown, rocky way (photo EH 37). 1125d is an unmaintained, overgrown way (photo DV 2). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-125 is contiguous with the unknown unit and unit 1-130 (see above), and it is roadless.

Unit 1-123 contains routes 1123a and 1123b. 1123a is an unmaintained, overgrown way (photo EH 28). 1123b is an unmaintained, overgrown way (photo EH 30). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-123 is contiguous with units 1-122, the unknown unit to the south of unit 1-123, and unit 1-124 (see above), and it is roadless.

Unit 1-134 was separated from unit 1-131 by PS-1134. This is an unmaintained, rocky way (photo DT 40). Also, unit 1-134 is not separated from the Hart Mountain National Antelope Refuge by a hard boundary. Actually, it appears that the boundary is purely subjective. Unit 1-134 also contains routes 1134a, 1134a2, and 1134b. 1134a is an unmaintained, overgrown way (photo DT 5). 1134b is an unmaintained, very overgrown way (photo DT 6). 1134a2 is an unmaintained, overgrown way (photo DT 12). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-134 is contiguous with units 1-131, 1-135 (see above), and the Hart Mountain National Antelope Refuge, and it is roadless.

Unit 1-127 is not separated from Hart Mountain National Antelope Refuge by a hard boundary. In fact, it is a subjective boundary. Unit 1-127 also contains routes BSi, BSj, and BSk. BSi is an unmaintained, rocky, rough way (photo DP 19). BSj is an unmaintained, rocky, rough way (photo DP 26). BSk is an unmaintained, overgrown, barely discernible way (photo DP 28). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-127 is contiguous with Hart Mountain National Antelope Refuge and units 1-124 and the unknown unit to the south (see above). It is also roadless.

Unit 1-115 was noted by BLM to be separated into two subunits by a road. However, we did not find any roads throughout the entirety of unit 1-115. This report examines the unit as a whole.

Unit 1-115 was not separated from the Hart Mountain National Antelope Refuge by a hard boundary. In fact, it appears to be a purely subjective boundary. Unit 1-115 also contains routes 1115a, 1115b, 1115d, 1115d1, 1115f, 1115e3, and 1115e4.. 1115a is an unmaintained, overgrown way (photos DR 13, 28, 29). 1115b is an unmaintained, overgrown ways (photo DR 16, 27). 1115d is an unmaintained, overgrown way (photos DR 10, 14, 15; DM 32). 1115d1 is an unmaintained, overgrown way (photos DR 7). 1115f is an unmaintained, overgrown, nearly impassable way (photos DR 11; DM 36). 1115e3 is an unmaintained way used only for a reservoir (photo DM17). 1115e4 is an unmaintained, nearly impassable way (photo DM 12). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-115 is contiguous with Hart Mountain National Antelope Refuge and should be viewed as one unit instead of two separate subunits because it is roadless.

Hart Mountain National Antelope Refuge contains routes BSa, BSb, BSc, BSd, BSg, BSg1, BSh, BSi, BSj, BSk, BSm, BSn, BSp, PSa, PSc, PSd, PSh, PSi, PSL, PSm, PSn, PSq, PSr, PSs, PSt, PSo, and PN-PS. BSa is considered part of the western boundary to Hart Mountain WSA, but it is an unmaintained, overgrown way (photos DP 7, 8, 11). BSb is actually a trail that leads to an overlook (photo DP 65). BSc is an unmaintained way (photo DP 66). BSd is an unmaintained, rocky, overgrown way (photo DP 62). After the hotsprings campground, the route becomes BSg, which is an unmaintained, rutted overgrown way (photo DP 58, 42, 43). BSg1 is an unmaintained, overgrown way (photo DP 59). BSh starts out as a road as it comes off of BS-PS (photo DP 37); however, it turns into an unmaintained, overgrown way shortly thereafter (DP 39, 41). Also, BSh is only open seasonally as can be seen in photo DP 39. BSi is an unmaintained, overgrown, nearly impassable way (photo DP 22). BSj is an unmaintained, rocky way (photo DP 26). BSk is an unmaintained, overgrown, barely visible way (photo DP 28). BSm is an unmaintained, overgrown, barely visible way (photo DP 12). BSn is road that leads to a private inholding (photo DP 45) and can be cherry stemmed. BSp is an unmaintained, overgrown way (photo DP 49). PSa is an unmaintained, overgrown way (photos DN 3, 8). PSc is an unmaintained, extremely rocky, overgrown way (photo DN 2). PSd is an unmaintained, overgrown way (photo DN 1). PSh is an unmaintained, overgrown way that is only open seasonally (photo DN 13, 26). PSi is an unmaintained, overgrown way (photo DN 20, 42). PSL is an unmaintained, overgrown way (photo DN 37, 38). PSm is an unmaintained, overgrown way (photo DN 33, 34, 36, 40; DT 5 (which is labeled 1134a on map)). PSn is an unmaintained, overgrown way that dead ends after approximately two miles (photos DN 27, 32). PSq is an unmaintained, overgrown way (photo DN 43). PSr is an unmaintained, overgrown way (photo DN 45). PSs is an unmaintained, overgrown, rocky way (photo DN 46). PSt is an unmaintained, overgrown way (photo DN 49). PSo is an unmaintained way (photo DN 35; DT 40). PN-PS starts out fairly well defined (photos DM 3, DN 6), but is becomes an unmaintained overgrown way shortly thereafter (photo, DN9; DM1).

Within Hart Mountain proposed WSA, there are a few maintained roads. BSe is a maintained road (photo DP 54) that leads to the hotsprings campground and can be cherry-stemmed to this point. BSe2 and BSe3 are small branches off of BSe that lead to various camping sites (photos DP 57, 56, respectively). BS-PS is a road until photo point DP 37, but it turns into an unmaintained, rutted way shortly thereafter (photo DN 47, 55). Because BSe and BS-PS do not bisect the area, these roads can be cherry stemmed.

Because the above ways are not being maintained by mechanical means to ensure regular and continuous use Hart Mountain National Antelope Refuge is contiguous with units 1-115, 1-127, 1-131, and 1-134 (see above), and it is not bisected by roads.

Hart Mountain proposed WSA consists of units 1-115, 1-123, 1-124, 1-125, 1-127, 1-128, 1-129, 1-130, 1-131, 1-132, 1-133, 1-134, and an unknown unit to the south of 1-128, and forms a contiguous area approximately 424,570 acres in size.

II. *Hart Mountain proposed WSA is primarily affected by the forces of nature.*

The unknown unit and Hart Mountain National Antelope Refuge have never been inventoried making all information presented in this report new a pertinent. The unknown unit to the south of unit 1-128 contained a reservoir (photos EL 6, 9) and private land, but they are not included in the wilderness because they have been cherry stemmed. Hart Mountain National Antelope Refuge contains a developed spring, pit toilet, camping sites, other developments associated with the refuge, and the Order of the Antelope building. However, these developments have all been cherry-stemmed and are not found within the wilderness.

Units 1-123, 1-125, 1-127, 1-128, 1-129, and 1-130 were all previously eliminated because they did not appear to be primarily affected by the forces of nature. Units 1-123, and 1-125 contained seedings, while units 1-125, 1-127, 1-128, 1-129, and 1-130 contained ways and reservoirs. However, many changes have occurred over the past 24 years making these developments appear more natural.

The seedings in units 1-123 and 1-125 are starting to become inundated with native vegetation, which gives it a natural appearance (photo EH 39). The ways found within units 1-125, 1-127, 1-128, 1-129, and 1-130 are becoming overgrown to the point where they have little impact to the landscape (see Section I). There are a few reservoirs found throughout the region, but most do not have a cumulative impact to the entirety of the area because they are small (photos DV 3, 19, 44; EH 32; EL 1), are screened by topography (photos DV 15, 23; EH 29, 33, 35; EL 11), or they are old lakebeds that have just been bermed at one end (photos DV 27; EH 19).

Because many of the manmade developments are excluded from the proposed WSA boundary or deteriorated making them appear more natural in the landscape, they do not have a cumulative impact to the area. This is especially true when looking at the proposed WSA as a whole. Therefore, the Hart Mountain proposed WSA appears in a generally natural condition and impacted primarily by the forces of nature (photos DN 17, 18, 25; DP 30; DV 25, 34, 35, 40; EH 7, 8, 9, 14, 17, 23, 24, 31, 38; EL 12, 13, 18, 20, 21, 51, 56, 57).

In addition, pronghorn (photo EL 32), loggerhead shrike, burrowing owl, golden eagle, northern harrier, American kestrel, canyon wren, golden crowned sparrow, black-billed magpie, song sparrow, chukars, bushtits, townsend's solitaire, red-tailed hawk, California quail, northern flicker, say's phoebe, western scrub jay, common raven, American robin, mountain chickadee, rock wren, mountain bluebird, sage thrasher, yellow-rumped warbler, white-crowned sparrow, horned lark, sage grouse, coyote, badger, mule deer, wild horses, jack rabbits, Becker's white butterfly, and a pygmy short-horned lizard were seen, which add a natural feeling to the area.

III. *Hart Mountain proposed WSA provides outstanding opportunities for solitude and primitive recreation.*

Most of the units within the Hart Mountain proposed WSA were eliminated due to lacking outstanding opportunities in solitude or primitive and unconfined recreation. Units 1-115, 1-130, and 1-133 were to flat or had exposed slopes. Units 1-124, 1-125, 1-127, 1-128, 1-129, 1-131, and 1-134 were too narrow or too small. However, each of these units was mentioned to have some opportunities for primitive or unconfined recreation, such as hunting, hiking, backpacking, wildlife observation, photography, and horseback riding.

Because the units are now contiguous with each other and with Hart Mountain National Antelope Refuge (see Section I), the above reasons for elimination are no longer valid. Sights and sounds of others can easily be avoided because the Hart Mountain proposed WSA (424,570 acres) is longer too narrow or too small. There are still many flat areas and exposed slopes, but they do not dominate the entirety of the proposed WSA and one could easily find areas that have topographic and vegetative screening.

For the same reasons, the primitive and unconfined forms of recreation that were listed by the BLM are outstanding in the proposed WSA. Because the area is so large, the recreation that can be found is no longer confining (photos DN 23; DR 17, 24; EL 55).

Therefore, Hart Mountain proposed WSA has outstanding opportunities for solitude and primitive and unconfined forms of recreation. The steep cliffs of Hart Mountain (photos DP 1, 5, 6, 9, 10, 13, 34), the varied topography (photos DM 12, 14; DN 15, 53, 54; DP 35, 50, 51, 52, 60; DR 18; DV 25, 30, 34, 35, 40, 49; EH 7, 8, 9, 12, 17, 31, 34; EL 4, 5, 12, 20, 21, 51, 52, 56, 57), the juniper and mahogany mountain stands (photos DN 48; DP 19, 30; EH 23, 24, 38; EL 13, 14, 18, 54), the cultural artifacts (photos DN 14, 16, 39; DR 19), the many lake beds (photos DR 21; EH 28, 30), and the multitude of pronghorn, sage grouse, and other wildlife (photos DN 5, 21, 22; DP 44; DR 6; EL 32) would easily allow Horseback riders, hikers, backpackers, hunters, photographers, and wildlife viewers to experience outstanding opportunities in solitude and primitive and unconfined forms of recreation.

XIII. *Hart Mountain proposed WSA has supplemental values that would enhance the wilderness experience and should receive wilderness protection.*

The Hart Mountain proposed WSA has a multitude of supplemental values including Guana Creek WSA, High Lakes ACEC, and habitat for many Federal Species of Concern.

Guano Creek WSA was noted in BLM's October, 1991 *Wilderness Study Report* to contain, "rare plants and native plant communities, paleontological resources, and habitat for the Sheldon tui chub and sage grouse." Pg 82.

The High Lakes ACEC has cultural, wildlife, and botanical values. The Lakeview RMP FEIS notes that the area contains, "High Density of rock art sites up to 7,000 years old. Diversity of plants and animals, especially cultural plants. Bureau sensitive plant found in the area. Evidence of long-term relationship of Tribal people and landscape. Critical sage grouse habitat." pg 2-58. In addition, the areas classic basin and range geology would also be great for rock hounds and geologic study, while the area is also home to some of the last quality sagebrush habitat found in the U.S.

In addition, the Greater Sage Grouse is a species of concern throughout its range with a population that is on a significant downward trend. Habitat fragmentation is one of the primary causes of this decline. The Hart Mountain proposed WSA provides prime habitat for this species as it is home to 63 known Sage Grouse Leks (see map). This area may also be home to the Pygmy Rabbit, California Bighorn Sheep, Burrowing Owl, and Peregrine Falcon, which are Federal Species of Concern.

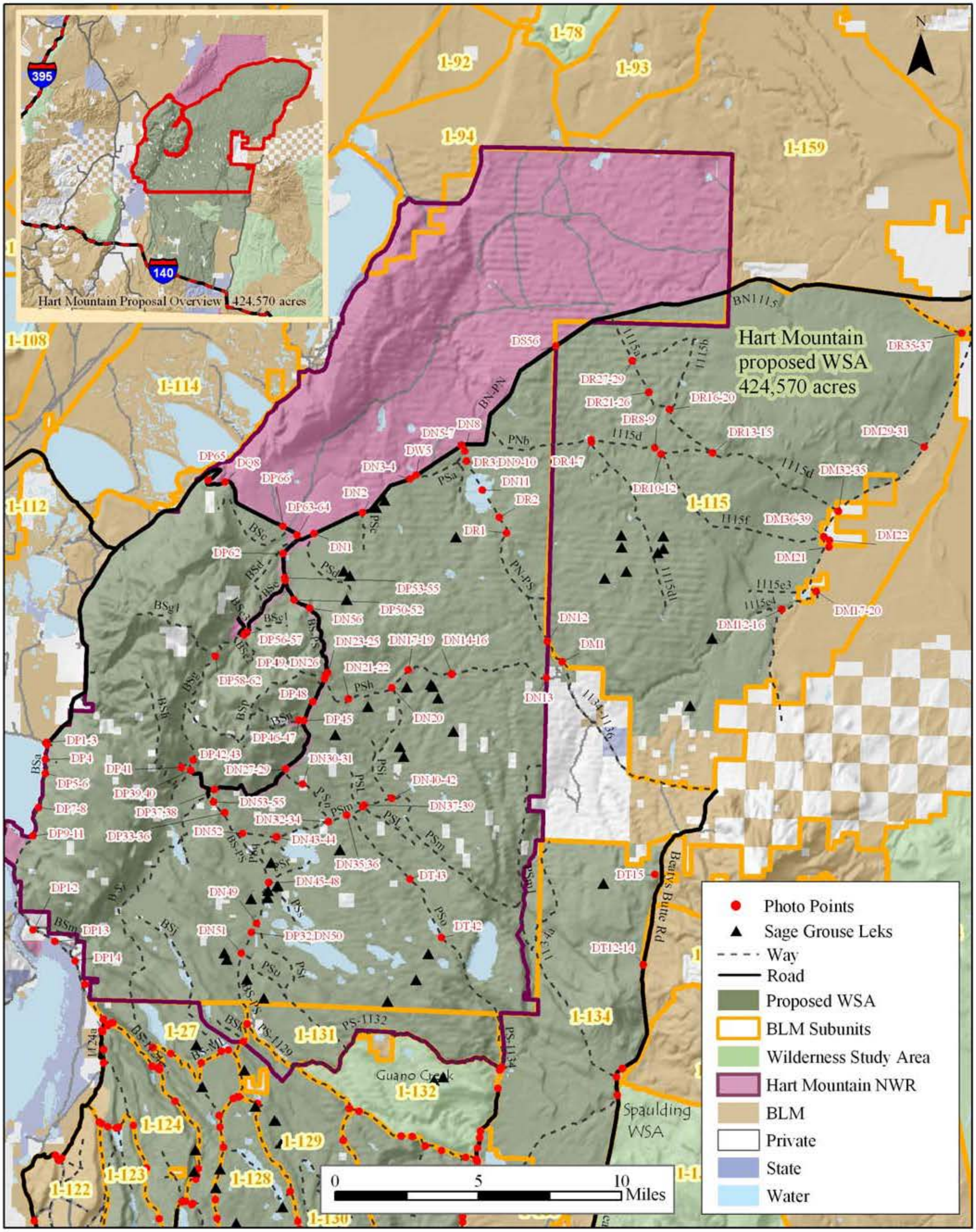
Summary:

This proposal contains lands within the Hart Mountain National Antelope Refuge, which have never been inventoried for wilderness characteristics. All information regarding these lands is new and pertinent information.

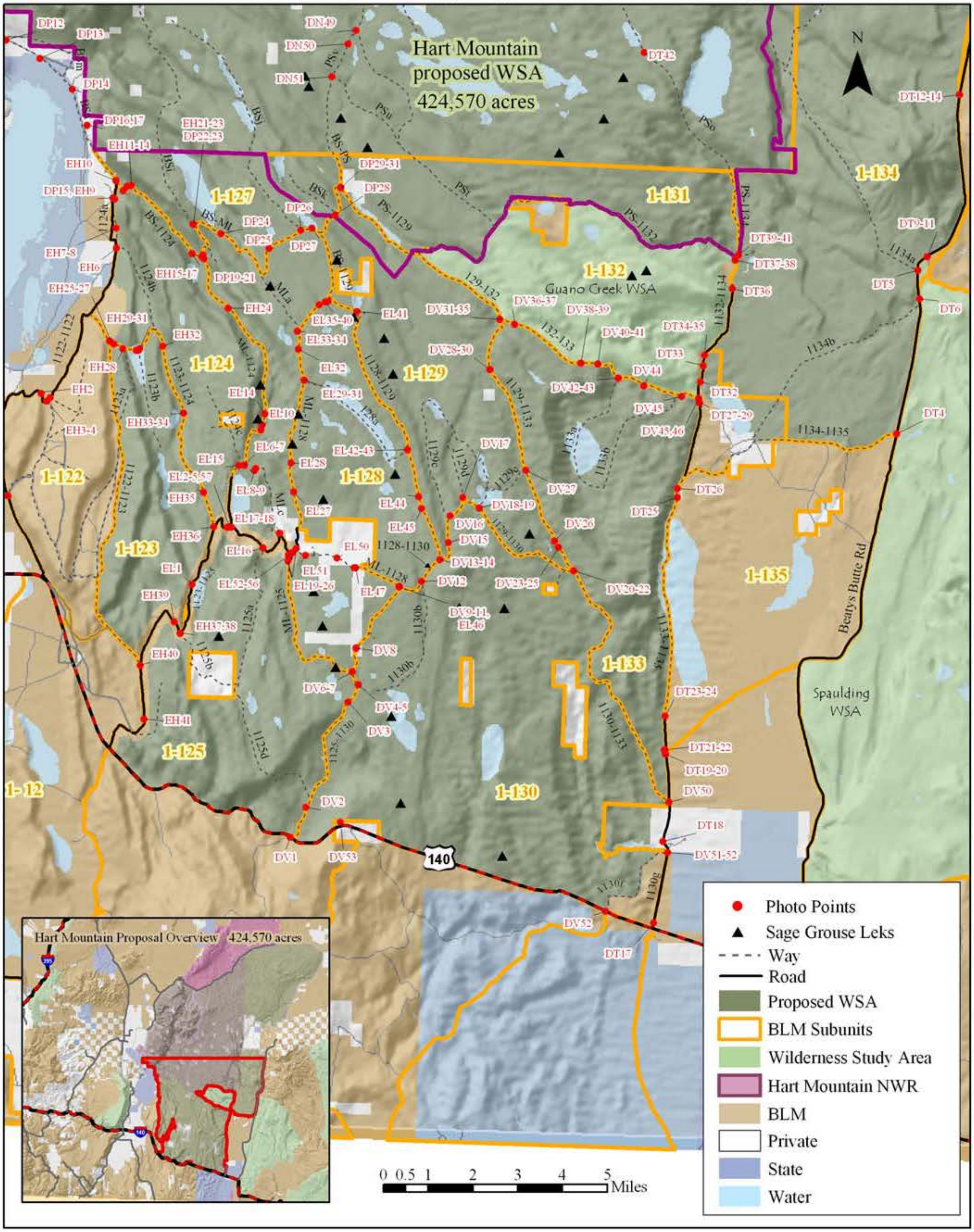
The BLM land was not recommended for WSA designation based on the original determination the units did not appear in a natural condition and did not offer outstanding opportunities for solitude and a primitive or unconfined type of recreation. Because many changes have occurred to the landscape since BLM's original inventory in the late 1970's, these original determinations have to be amended.

We have provided new information, including geo-referenced digital images, documenting that the proposed Hart Mountain WSA meets wilderness criteria. The proposed WSA is roadless, is in an apparently natural condition, contains outstanding opportunities for solitude and recreation, and possess supplemental values. This area deserves to be designated as a Wilderness Study Area.

Hart Mountain proposed WSA map I



Hart Mountain proposed WSA map II



Spaulding proposed WSA Addition

The purpose of this report is to present new information documenting that the area in question meets wilderness criteria and therefore qualifies for interim protection as a Wilderness Study Area. This information differs significantly from the information provided in the BLM's prior inventory.

The area:

The Spaulding proposed WSA Addition totals approximately 121,485 acres and is bordered on the south by road 6156 and highway 140, on the west by Spaulding WSA and Beaty's Butte Road, on the north by private property, and east by Beaty's Butte Road.

The Spaulding proposed WSA Addition consists of the following units:

- 1-136, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the small size of the unit did not allow for outstanding opportunities in solitude or recreation.
- 1-137, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the unit had a considerable portion that was not in an apparently natural condition, and the steep hills, low vegetation, and small size of the unit did not allow for outstanding opportunities for solitude or primitive and unconfined recreation.
- 1-138, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the low vegetative cover and small size of the unit did not allow for outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-140, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the small size of the unit did not allow for outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-142, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the low vegetative cover and small size of the unit did not allow for outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-143, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the low vegetative cover, broad flat expanses, and lack of any geographic feature in the unit did not allow for outstanding opportunities in solitude or primitive and unconfined recreation.
- 1-145, which was eliminated in BLM's November, 1980 *Final Intensive Inventory Decisions* because the extremely flat terrain and small size of the unit did not allow for outstanding opportunities in solitude or primitive and unconfined forms of recreation.
- An unknown BLM unit northeast of unit 1-145, which has not been previously inventoried. All information presented in this report is new and relevant.
- An unknown BLM unit just south of unit 1-145, which has not been previously inventoried. All information presented in this report is new and relevant.

This report will refute each of the preceding rationale and demonstrate that Spaulding proposed WSA Addition does in fact meet wilderness criteria. If designated as a WSA, it would increase the Spaulding WSA from 68,895 acres to approximately 190,380 acres.

Wilderness characteristics:

I. *Spaulding proposed WSA Addition is contiguous with designated lands, and the units within are contiguous with each other.*

The Spaulding proposed WSA Addition totals approximately 121,485 acres and is bordered on the south by road 6156 and highway 140, on the west by Spaulding WSA and Beaty's Butte Road, on the north by private property, and east by Beaty's Butte Road. Within this area, there are no roads that bisect the area.

BLM's wilderness policy states that a "way" maintained solely by the passage of vehicles does not constitute a road. If a "way" is used on a regular and continuous basis, it is still not a road. A vehicle route that was constructed by mechanical means *but is no longer being maintained by mechanical methods* is NOT a road. A road, by comparison, is a vehicle route that has "been improved and maintained by mechanical means to ensure relatively regular and continuous use."

Unit 1-136 was separated from units 1-137 and 1-142 by routes 1136-1137 and 1136-1142, respectively. 1136-1137 is an unmaintained, overgrown way (photos DL 1, 6, 12). 1136-1142 is an unmaintained, overgrown way (photos DL 14, 17, 19). Unit 1-136 also contains routes 1136a, 1136b, 1136b1 and 1136c. 1136a is an unmaintained, overgrown way (photos DL 4, 5). 1136b is an unmaintained, overgrown way (photo DL 18). Because 113b1 branches off of way 1136b, it is a way. 1136c is an unmaintained, overgrown way (photo DL 21). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-136 is contiguous with units 1-137 and 1-142. Unit 1-136 is also a roadless area.

Unit 1-137 was separated from units 1-138 and 1-142 by 1137-1138 and 1137-1142, respectively. Route 1137-1138 is an unmaintained, overgrown, rocky way (photo DL 41), while 1137-1142 is and unmaintained, overgrown way (photos DL 13, 39). Within unit 1-137, only route 1137a exists. 1137a is an unmaintained, overgrown, rutted way (photos DL 43, 44). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-137 is contiguous with units 1-136 (see above), 1-138, and 1-142. It is also a roadless area.

Unit 1-138 was separated from units 1-142, 1-143, and Spaulding WSA by 1138-1142, 1138-1143, and 1134d, respectively. 1138-1142 is an unmaintained, overgrown, rutted way (photos DL 34, 38). 1138-1143 is an unmaintained, overgrown, rutted way (photo DL 35, DU 20), which is very hard to access from road 6156 because the way ends at a reservoir (photo DU 19). 1134d is partially a fenceline way (photo DT 7), and after a short distance, it turns into an unmaintained, overgrown way that is nearly impassable (photo DT 8). There are no other roads/ways within unit 1-138. Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-138 is contiguous with units 1-137 (see above), 1-142, 1-143, and Spaulding WSA. Unit 1-138 is also a roadless area.

Unit 1-142 was separated from unit 1-143 by 1142-1143. 1142-1143 is an unmaintained, overgrown, rutted way (photos DL 23, 30, 31, 33). Unit 1-142 also contains routes 1142a, 1142a1, 1142b, 1142c, and 1142c1. Because 1142a and 1142a1 can only be accessed by way 1137-1142 (see above), they are also ways. 1142b is an unmaintained, overgrown, impassable way (photo DL 37). 1142c and 1142c1 are unmaintained, overgrown ways (photo DL32; 1142c is on the right, while 1142c1 is on the left in the picture). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-142 is contiguous with units 1-136 (see above), 1-137 (see above), 1-138 (see above), and 1-143. Unit 1-142 is also a roadless area.

Unit 1-143 was separated from Spaulding WSA by 1138-1143. 1138-1143 is an unmaintained, overgrown, rutted way (photo DL 35, DU 20), which is very hard to access from road 6156 because the way ends at a reservoir (photo DU 19). Unit 1-143 also contains routes 1143b, 1143c, and 1143-1144. 1143b is an unmaintained, overgrown, rutted way (photos DL 27, 29). Because 1143c can only be accessed by ways 1138-1143 and 1134d (see above), it is also a way. 1143-1144 is an unmaintained, overgrown way (photos DU 14, 15). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-143 is contiguous with units 1-138 (see above), 1-142 (see above), and Spaulding WSA. Unit 1-143 is also a roadless area.

Unit 1-145 was separated from Spaulding WSA, unit 1-140, and an unknown unit to the northeast by 1139-1145, 1140-1145, and SF-1145, respectively. 1139-1145 is maintained solely by vehicle traffic, which does not meet a definition of a road. It is an unmaintained, rutted way (photos DU 35, 37, 38, 39). 1140-1145 is an unmaintained way (photo DU 40), and this lack of maintenance is exemplified near a spring where the way totally disappears (photo DU 45). SF-1145 shows no indication of improvement or maintenance and is being maintained solely by vehicle traffic, which does not make it a road. Therefore, SF-1145 is an unmaintained, rutted, overgrown way (photos DU 30, 31, 33). Unit 1-145 also contains route SFa. This is an unmaintained way (photos DU 36, 47). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-145 is contiguous with Spaulding WSA, unit 1-140, and the unknown unit to the northeast. Unit 1-145 is also a roadless area.

Unit 1-140 was separated from Spaulding WSA by 1139-1140. This route is being maintained by vehicle traffic, which does not make it a road. Therefore, 1139-1140 is an unmaintained, overgrown way (photos DU 41, 52). Unit 1-140 also contains routes 1140a, 1140b, 1140c, and 1140e1. 1140a is a way because it can only be accessed by way 1139-1140. 1140b is a way because all routes leading to it are ways. Also, we tried to get photos of 1140b, but we could not access it because there were too many cows were in the way. 1140c is an unmaintained, overgrown way (photo DU 50). 1140e1 is an unmaintained, overgrown way (photo DU 51). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, unit 1-140 is contiguous with Spaulding WSA and unit 1-145 (see above). Unit 1-140 is also a roadless area.

There is a small, unknown BLM unit to the south of unit 1-145 and southeast of unit 1-140. This unit was separated from unit 1-140 by SF-1140 and from unit 1-145 by SF-1145a. SF-1140 appears to have been bladed at one time in the past (photo DU 49). However, it has been some time since maintenance has occurred because SF-1140 is starting to become overgrown. Moreover, it becomes a way by the time it reaches photo point DU 43-45. Because SF-1140 does not dissect the unit, we can cherry stem it to the private inholding without impacting the naturalness of the proposed addition. SF-1145a is an unmaintained, rocky, overgrown way (photos DU 43, 46). This unknown unit also contains route 1140e. This is an unmaintained, overgrown way (photos DU 44, 48). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, this unknown unit is contiguous with units 1-140 and 1-145. It is also a roadless area.

To the northeast of unit 1-145 is an unknown BLM unit. This unit was separated from Spaulding WSA by SFa. This is an unmaintained, overgrown way (photos DU 22, 23, 24, 34). Because these ways are not being maintained by mechanical means to ensure regular and continuous use, this unknown unit is contiguous with units 1-145 (see above) and Spaulding WSA. It is also a roadless area.

Units 1-136, 1-137, 1-138, 1-140, 1-142, 1-143, 1-145, and two unknown units combine to form a roadless area approximately 121,485 acres in size. As the units are not separated from the Spaulding WSA, it would increase the area of the WSA from 68,895 acres to approximately 190,380 acres.

II. *Spaulding proposed WSA Addition is primarily affected by the forces of nature.*

Unit 1-137 was eliminated from wilderness review in BLM's November, 1980 *Wilderness Final Intensive Inventory Decisions* because the western and southern portions of unit were not in a natural state. The unit was said to have contained 3.5 miles of ways, 4 miles of fenceline, and 2 small reservoirs. It was also noted that these manmade features were noticeable throughout 30 percent of the unit. Unit 1-137 still has a way running through the unit (1137a) and a reservoir (photo DL 11 – although this is on private property), but because this unit is now a part of a larger contiguous unit totaling 190,380 acres, these manmade features no longer have a cumulative impact on the area. Furthermore, all the other units within the Spaulding proposed WSA Addition, including Spaulding WSA, were noted to be primarily affected by the forces of nature. By having only a small portion of one unit to not appear primarily affected by the forces of nature would not affect the overall area of the Spaulding WSA Addition. Therefore, the Spaulding proposed WSA Addition is primarily affected by the forces of nature (photos DL 7, 8, 22, 24, 25, 36; DU 28, 42).

Several other attributes documented during this inventory added to the naturalness of the area. Native sagebrush, bunchgrass, mountain mahogany, willow, and rabbitbrush showed that that area is primarily affected by the forces of nature. Additionally, several species of wildlife, such as golden eagle, loggerhead shrike, pronghorn, sage grouse, northern harrier, chukar, and black-tailed jack rabbit, were seen during this inventory and added a natural feeling to the area.

III. *Spaulding proposed WSA Addition provides outstanding opportunities for solitude and primitive recreation.*

Units 1-136, 1-137, 1-138, 1-140, 1-142, 1-143 and 1-145 were all eliminated from further wilderness review in BLM's November 1980 *Wilderness Final Intensive Inventory Decisions* because they did not offer outstanding opportunities in solitude and recreation.

Units 1-136, 1-137, 1-138, 1-140, and 1-142 were noted by the BLM to have some form of solitude and recreation. 1-136 was noted to have moderate opportunities for solitude, while offering hiking, photography, wildlife observation, and hunting opportunities. 1-137 was noted to offer potential hiking, hunting, wildlife observation, and photography opportunities. 1-138 was noted to have hiking and scenic opportunities. 1-140 was noted to have hunting, trapping, hiking, and horseback riding opportunities. 1-142 was noted to have some secluded spots where one could be isolated and opportunities for hunting, hiking, horseback riding, photography, and wildlife observation. However, these opportunities were not outstanding because these units were too small. Now that these units are all contiguous with one another and with Spaulding WSA forming a roadless area approximately 190,380 acres, small size is no longer an issue. Each of the above opportunities easily becomes outstanding.

Units 1-143 and 1-145 were noted by BLM to be too flat to allow for any solitude or primitive and unconfined recreation. However, it is mentioned in H-6310-1 *Wilderness Inventory and Study Procedures* handbook that, "do not assume that simply because an area or portion of an area is flat and/or unvegetated, it automatically lacks an outstanding opportunity for solitude…Consideration must be given to the interrelationship between size, screening, configuration, and other factors that influence solitude." p14 Because this these units are now contiguous with other units and Spaulding WSA, it doesn't matter that these areas lack topography. In fact, these areas add diversity to the Spaulding proposed WSA Addition for both wildlife habitat and recreation opportunities.

When looking at the entirety of Spaulding WSA Addition, one can easily find outstanding opportunities for solitude and recreation. The diverse topography of the area would easily allow visitors to avoid the sights and sounds of others, while offering outstanding opportunities for hiking, horseback riding, photography, sightseeing, wildlife viewing, hunting, and camping (photos DL 2, 3, 7, 8, 9, 10, 12, 17, 19, 22, 24, 25, 36, 42; DU 28, 42, 45). Moreover, the outstanding opportunities for solitude and recreation found in the addition would further enhance the wilderness characteristics found in Spaulding WSA.

XXI. *Spaulding proposed WSA Addition has supplemental values that would enhance the wilderness experience and should receive wilderness protection.*

The BLM noted in their inventory that the area probably has archeological values. This is probably the case since lithic scatter was found on the ground in many places. The springs within the unit add ecological value because of the habitat they provide wildlife. Beatys Butte and the neighboring Catlow Rim and Hawks Mountain provide scenic value to the area.

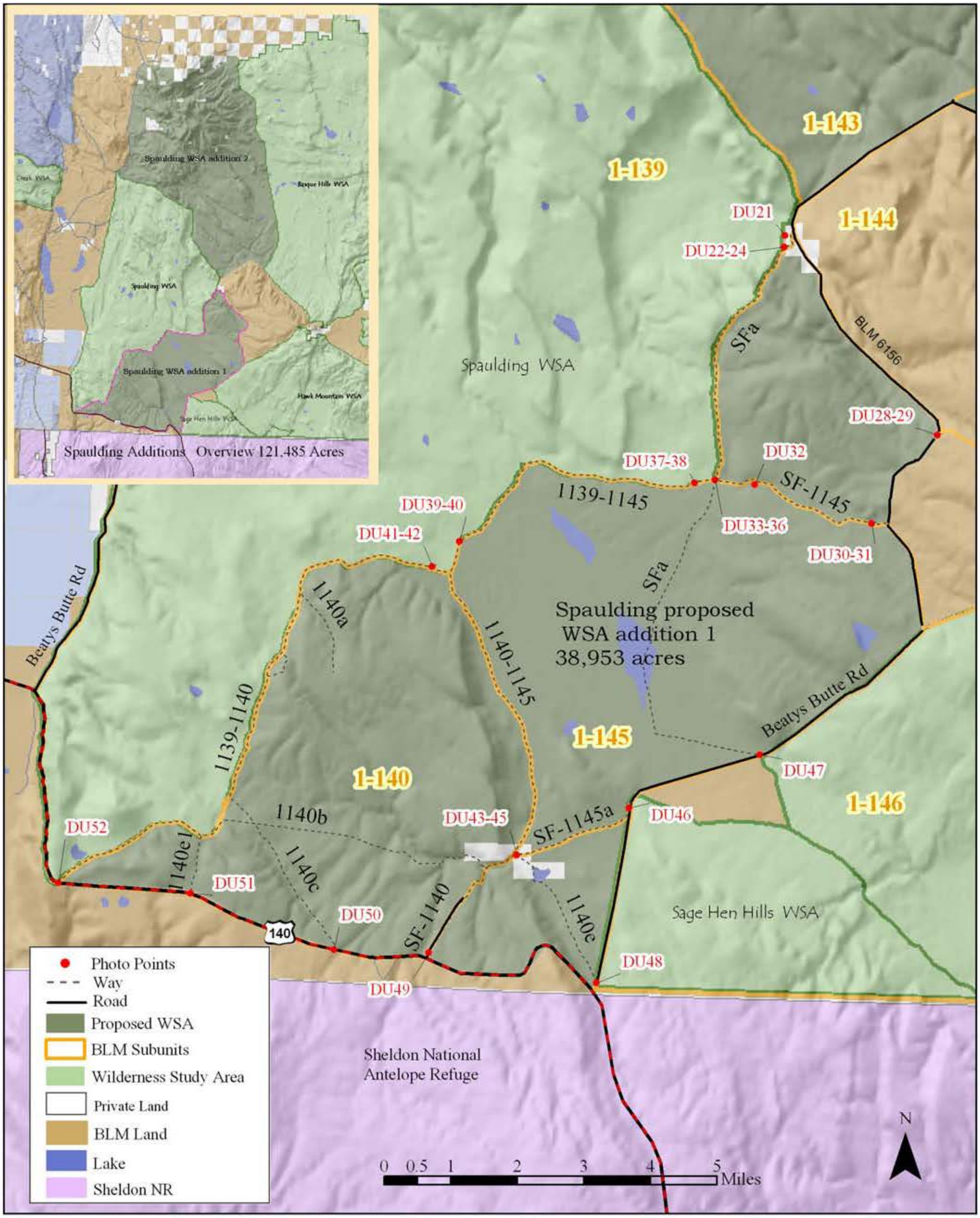
The Greater Sage Grouse is a species of concern throughout its range with a population that is on a significant downward trend. Habitat fragmentation is one of the primary causes of this decline. The Spaulding proposed WSA Addition provides prime habitat for this species as it is home to eleven known Sage Grouse Leks (see map). This area may also be home to the Pygmy Rabbit, California Bighorn Sheep, Burrowing Owl, and Peregrine Falcon, which are Federal Species of Concern.

Summary:

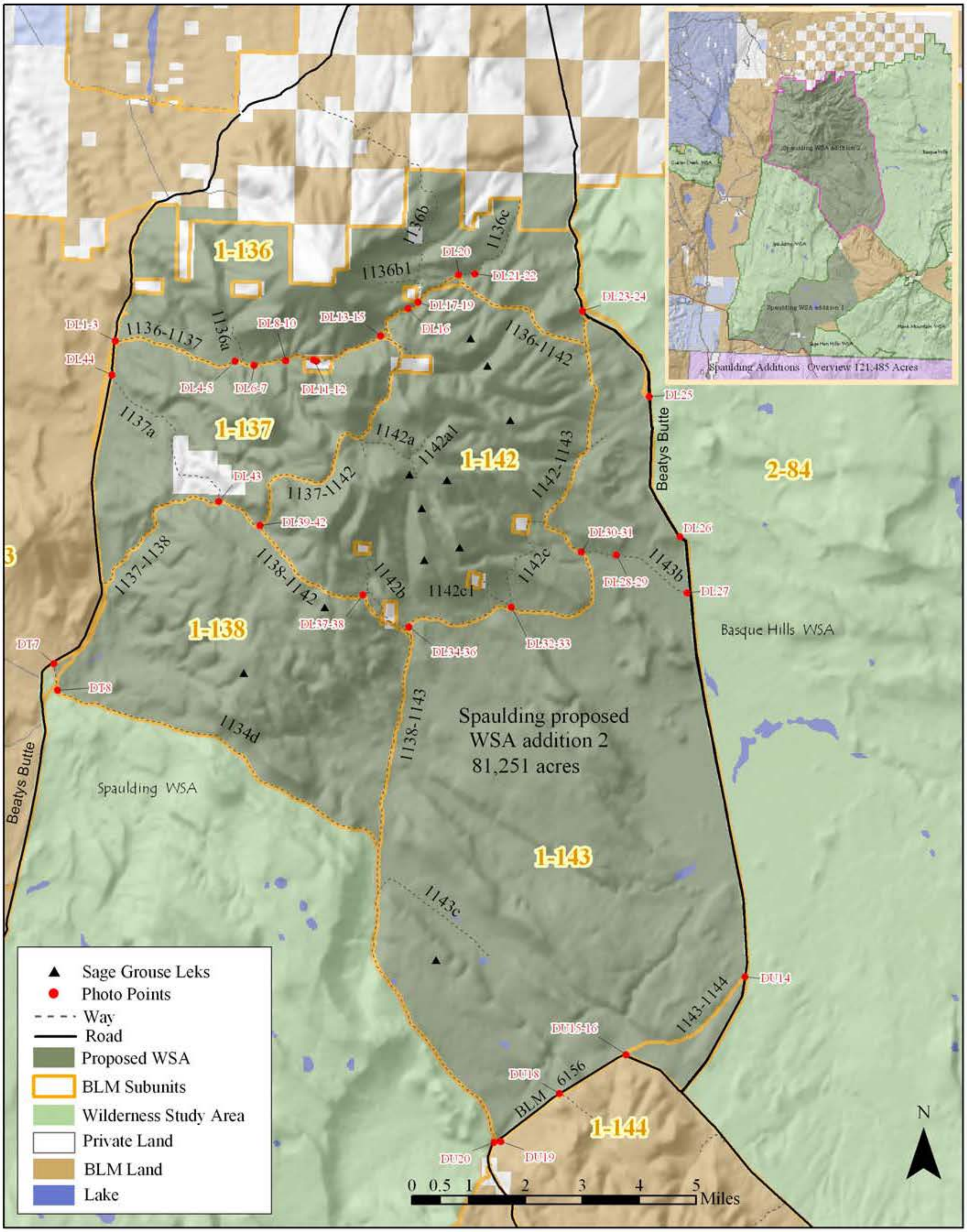
This area was not recommended for WSA designation based on the original determination that part of one unit did not appear in a natural condition, while other units did not offer outstanding opportunities for solitude or primitive and unconfined recreation. Because many changes have occurred to the landscape since BLM's original inventory in the late 1970's, these original determinations have to be amended.

We have provided new information, including geo-referenced digital images, documenting that the proposed Spaulding WSA Addition meets wilderness criteria. The Addition is roadless, is not separated from the Spaulding WSA by roads, is in an apparently natural condition, contains outstanding opportunities for solitude and recreation, and possesses supplemental values, especially when combined with the Spaulding WSA. This area deserves to be designated as a Wilderness Study Area.

Spaulding proposed WSA Addition I



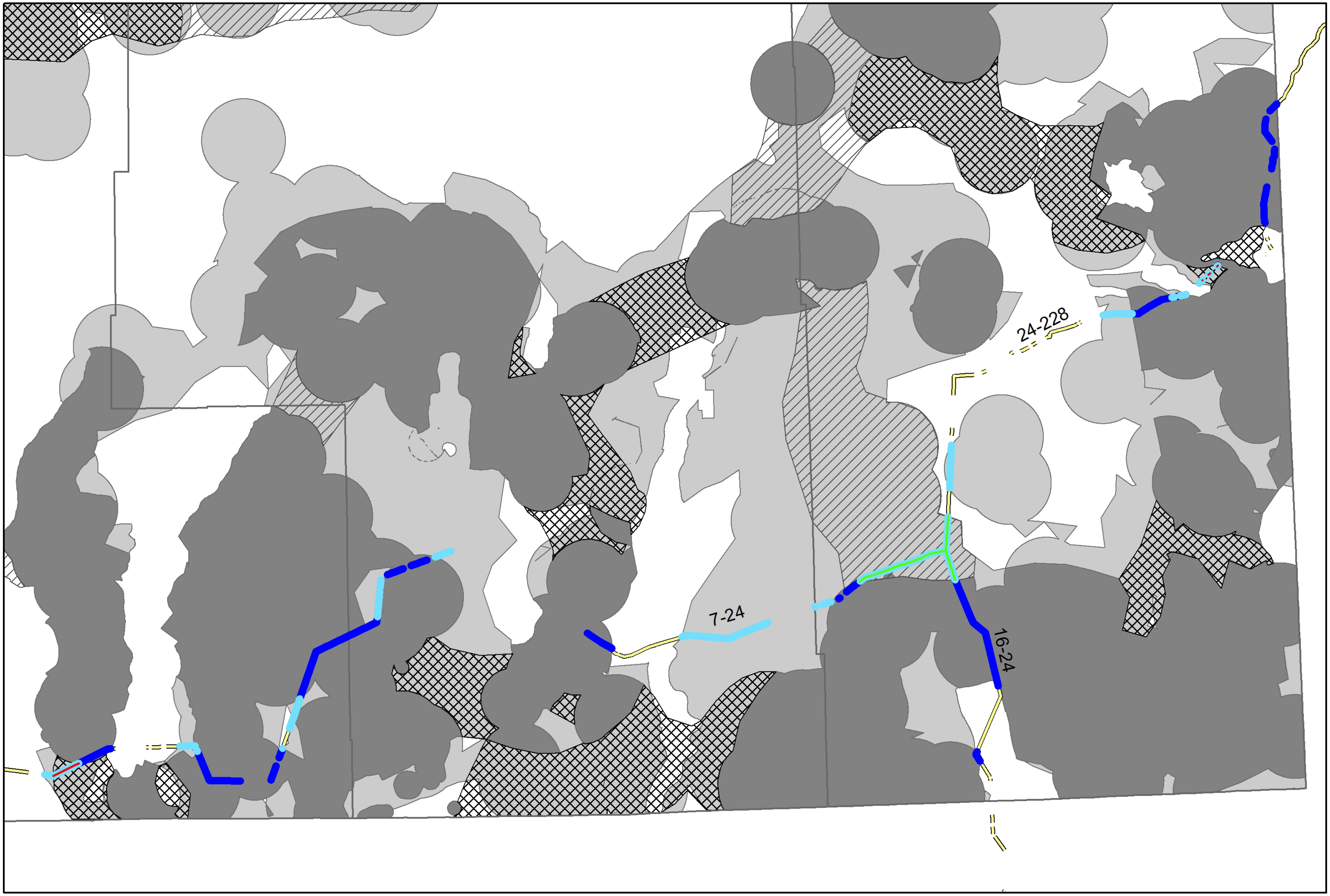
Spaulding proposed WSA addition 2



2014 Request for Information

WWEC Corridor Intersecting Greater Sage Grouse Habitat

Public Input



WWEC_intersect_GSG_040814.mxd

Sage-Grouse Habitat

PPH (Core)

PGH (Low Density)

Sage-Grouse Connectivity Corridor

ONDA Critical Corridor

ONDA Potential Corridor

Energy Corridor

Energy Corridor Intersects:

PPH Core Area (75.3 miles)

PGH Low Density (57.8 miles)

ONDA Critical Corridor (4.0 miles)

ONDA Potential Corridor (19.3 miles)

N W E S

0 10 20 Miles

Intersection Mileage Summary

Energy Corridor	Intersect	Miles
7-24	Core Area	41.5
7-24	Low Density	40.1
24-228	Core Area	17.6
24-228	Low Density	13.7
16-24	Core Area	16.2
16-24	Low Density	3.9
7-24	ONDA Critical Corridor	3.5
7-24	ONDA Potential Corridor	11.1
24-228	ONDA Critical Corridor	0.5
24-228	ONDA Potential Corridor	4.3
16-24	ONDA Potential Corridor	3.9
7-24	LWC	6.0
7-24	Citizens Wilderness Inventory	31.6
24-228	WSA	2.0
24-228	Other Potential WSA Intersect	3.9
16-24	LWC	0.8
7-24	Geothermal withdrawal area	17.9