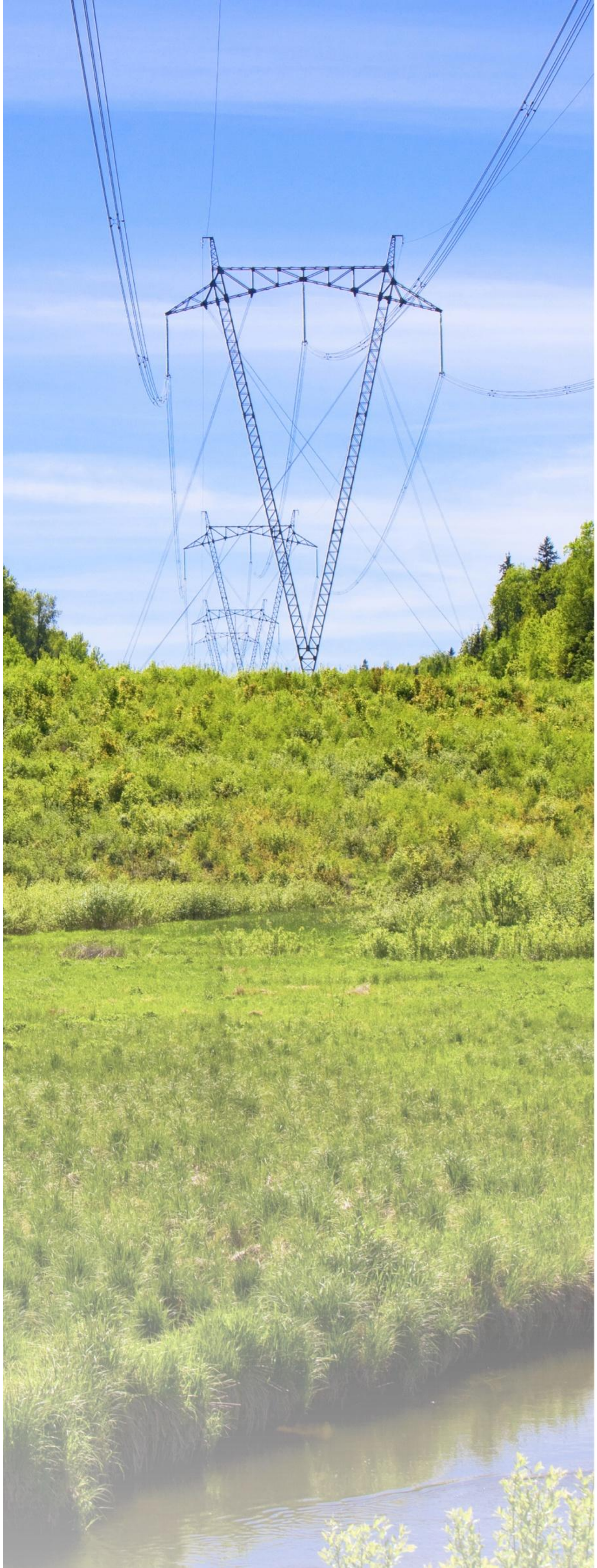

August 2011

Energy Transport Corridors:

The Potential Role of Federal Lands in States Identified by the Energy Policy Act of 2005, Section 368(b)

Prepared by Argonne National Laboratory

U.S. DEPARTMENT OF ENERGY

U.S. Department of Agriculture, Forest Service

U.S. Department of the Interior

U.S. Department of Defense

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The Potential Role of Federal Lands in States Identified by the Energy Policy Act of 2005, Section 368(b)

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NOTATION

The following is a list of acronyms and abbreviations and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

ANOI	Advanced Notice of Intent
ARS	Agricultural Research Service
BLM	Bureau of Land Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
CAPP	Canadian Association of Petroleum Producers
CFR	*Code of Federal Regulations*
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EA	environmental assessment
EAC	Electricity Advisory Committee
EIA	Energy Information Administration
EIS	environmental impact statement
EPAct	Energy Policy Act of 2005
ERCOT	Electric Reliability Council of Texas, Inc.
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
FRCC	Florida Reliability Coordinating Council
HEBCO	Hawaiian Electric Company
INGAA	Interstate Natural Gas Association of America
IOP	interagency operating procedure
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MMS	Minerals Management Service
MOU	Memorandum of Understanding
MRO	Midwest Reliability Organization
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NFS	National Forest System

NHPA	National Historic Preservation Act
NPCC	Northeast Power Coordinating Council
NPS	National Park Service
NWRS	National Wildlife Refuge System
PADD	Petroleum Administration for Defense District
PEIS	programmatic environmental impact statement
POC	point of contact
RE	Regional Entity
RFC	Reliability*First* Corporation
ROW	right-of way
SERC	SERC Reliability Corporation
SPP	Southwest Power Pool
SUA	Special Use Authorization
TAPS	Trans-Alaska Pipeline System
TRE	Texas Regional Entity
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	*United States Code*
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WECC	Western Electricity Coordinating Council
WPA	Washington Policy and Analysis, Inc.

UNITS OF MEASURE

Bcfd	billion cubic feet per day
cm	centimeter(s)
GW	gigawatt(s)
in.	inch(es)
km	kilometer(s)
km^2	square kilometer(s)
kV	kilovolt(s)
MW	megawatt(s)
mi	mile(s)
mi^2	square mile(s)
Tcf	trillion cubic feet

1 INTRODUCTION

1.1 REPORT AUTHORITY: SECTION 368(B) OF THE ENERGY POLICY ACT OF 2005

On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPAct) into law. In Subtitle F of EPAct, Congress set forth various provisions that would change the way certain federal agencies[1] (Agencies) coordinate to authorize the use of land for a variety of energy-related purposes. As part of Subtitle F of EPAct, Section 368 addresses the issue of energy transportation corridors on federal land for oil, gas, and hydrogen pipelines, as well as electricity transmission and distribution facilities. Because of the critical importance of improving the nation's electrical transmission grid, Congress recognized that electricity transmission issues should receive added attention when the Agencies address corridor location and analysis issues. In Section 368, Congress specifically directed the Agencies to consider the need for upgraded and new facilities to deliver electricity:

> "[. . .] In carrying out [Section 368], the Secretaries shall take into account the need for upgraded and new electricity transmission and distribution facilities to (1) improve reliability; (2) relieve congestion; and (3) enhance capability of the national grid to deliver electricity."

Section 368 *does not* require the Agencies to consider or approve specific projects, applications for rights-of-way (ROWs), or other permits within designated energy corridors. Importantly, Section 368 *does not* direct, license, or otherwise permit any on-the-ground activity of any sort. If an applicant is interested in obtaining an authorization to develop a project within any corridor designated under Section 368, the applicant would have to apply for a ROW authorization and applicable permits. The Agencies would consider each application by applying appropriate project-specific reviews under requirements of laws and related regulations, including, but not limited to, the National Environmental Policy Act (NEPA), the Clean Water Act, the Clean Air Act, Section 7 of the Endangered Species Act (ESA), and Section 106 of the National Historic Preservation Act (NHPA).

Under Section 368, Congress divided the United States into two groups of states: the 11 contiguous western states and the remaining states. Direction for energy transportation corridor analysis and selection in the 11 western states was addressed in Section 368(a) of EPAct, while direction for energy transportation corridor analysis and selection in all other states[2] was addressed under Section 368(b) of EPAct. It was clearly the priority of Congress to conduct corridor location studies and designation first on federal lands in the western states. Under Section 368(a), the Agencies produced a programmatic environmental impact statement (EIS), *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE and DOI 2008), that was used in part as the basis for designating more than 6,000 mi (9,656 km) of energy transportation corridors on federal land in 11 western states. Under Section 368(a), Congress clearly stated the Agencies needed to (1) designate energy

[1] U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Energy, and U.S. Department of Commerce.

[2] Alabama, Alaska, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, and Wisconsin.

transportation corridors on federal land, (2) conduct the necessary environmental review of the designated corridors, and (3) incorporate the designated corridors into the appropriate land use plans.

Congressional direction under Section 368(b) of EPAct differs from that provided under Section 368(a). Specifically, Section 368(b) requires the secretaries of the Agencies, in consultation with the Federal Energy Regulatory Commission (FERC), affected utility industries, and other interested persons, to jointly:

- Identify corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land in states other than the 11 western states identified under Section 368(a) of EPAct, and

- Schedule prompt action to identify, designate, and incorporate the corridors into the applicable land use plans.

While Section 368(a) clearly directs designation as a necessary first step for energy transportation corridors in the 11 western states, Section 368(b) directs the Agencies to first identify corridors and then schedule prompt action to identify, designate, and incorporate the corridors into applicable land use plans. To comply with the congressional direction provided in Section 368(b), the Agencies investigated corridor identification issues in the Section 368(b) states; this report to Congress provides information that could be relevant to possible future designation of energy corridors. Future designations, if appropriate and necessary, would occur when the Agencies undertake revisions and/or updates to land use plans that guide management decisions on lands located within individual administrative units, such as specific National Forests, National Parks, or Wildlife Refuges. At this time, the Agencies are not proposing any actions or decisions related directly or indirectly to designating energy corridors on federal land under Section 368(b) of EPAct; however, the Agencies are not precluded from doing so in the future and anticipate discussing corridors in the areas referenced on page 5-1, particularly in the Northern Great Lakes, the Ozarks, New England, and the Appalachians (Figure 1.1). The information presented in this report characterizes the current energy transportation infrastructure on federal lands, examines the energy transportation situation in the Section 368(b) states, and presents the Agencies' policies and requirements that guide and manage energy-transportation land use planning and the processing of applications to cross federal land.

1.2 BACKGROUND

On October 3, 2008, the U.S. Department of Energy (DOE), as lead agency, issued a *Federal Register* notice to solicit public comments and determine public and stakeholder interest in energy transportation corridors in the Section 368(b) states. The *Federal Register* notice (FR 73:57613–57616) included an Advanced Notice of Intent (ANOI) to prepare a programmatic environmental impact statement (PEIS) and a notice of floodplains and wetlands involvement. The ANOI asked for early comments and suggestions from federal and state agencies, Tribal and local governments, the public, and other interested parties that could assist the Agencies in identifying the location of potential Section 368(b) corridors on federal lands, help define a preliminary range of reasonable alternatives, assist in corridor location screening criteria, and outline the potential environmental impacts related to the Agencies' designation of Section 368 corridors on federal land in 39 states. Comments concerning where corridors might be located would also be used to help inform a DOE decision on where to hold public meetings, if necessary.

The ANOI also included summary information that highlighted purpose and need, proposed action and alternatives, screening criteria, and identification of environmental issues. Importantly, the ANOI pointed out some fundamental differences between federal lands in the 11 western states and federal lands in the remaining 39 states addressed in Section 368(b) of EPAct:

> "Within the 39 States addressed by the proposed action, the Federal government owns 21.2% of the total land area with the FS, DOD, U.S. Fish and Wildlife Service, and National Park Service being the principal land stewards. Federal land comprises a small percentage of the 39 States in comparison with the high percentage of Federal land in the 11 Western States. Only 4.8% of the total land area within the 37 contiguous States and 8.9% [*sic*] of Hawaii is Federal land whereas about 50% of the 11 Western states are Federal lands. Alaska, whose land area is 58.1% Federal, is the one notable exception. As opposed to the 11 Western States, where development on Federal land is clearly necessary to improve energy delivery to population centers, it is unclear that Section 368 corridors in all 39 States, particularly those with relatively few acres of Federal land, would improve energy delivery significantly enough to warrant their designation. The Agencies hope to receive comments from the general public, Tribes, States, and industry, during the NEPA process, to help identify not only environmental considerations relevant to designating Section 368 corridors but also where designated Section 368 corridors would serve the broad goal of improving energy delivery."

There were relatively few and minor responses by the public, state and local government officials, and interested stakeholders to the information requests outlined in the ANOI. Indeed, only one organization, a Tribal government, responded to DOE with a request for information on new corridor locations. The Tribal government had identified a potential need for corridors in the panhandle of the State of Alaska to transport electricity between Canada and Alaska. Further communications between the Tribe and DOE resulted in the Tribe withdrawing its request because a Tribal official identified potential solutions that would not require new corridor designation under Section 368(b). Other comments received in response to the ANOI focused on environmental and regulatory issues, but these comments did not identify any potential specific or general corridor locations within the Section 368(b) states.

The very limited public and/or stakeholder response to the request for information outlined in the ANOI, especially the lack of any potential corridor locations put forth or identified by the public, state and local governments, utilities, or other interested stakeholders, clearly demonstrated the absence of identified, immediate public interest in new corridors on federal land within the Section 368(b) states. This lack of identified need, combined with (1) the relatively small amount of federal land in these states (especially compared to the 11 western states), and (2) the often single priority land use management purposes for these federal lands (e.g., parks, wildlife refuges, and trails), resulted in the Agencies' determination that they would not, at this time, develop a proposed action or decision to identify and designate Section 368(b) energy transportation corridors on federal lands within the Section 368(b) states. Therefore, the Agencies would not undertake a NEPA review as had occurred for Section 368(a) of EPAct.

1.3 SCOPE OF REPORT

The agencies are not proposing corridor designations. As such, they are not proposing an action that may have a significant impact on the human environment and have determined that they need not prepare an EIS or environmental assessment (EA) to comply with NEPA. DOE has determined that this report is categorically excluded from further NEPA review under DOE's NEPA regulations (Title 10, Part 1021, of the *Code of Federal Regulations* [10 CFR

Part 1021], Appendix D, Subpart A). However, the Agencies recognize that the public, Congress, and federal land managers would benefit from information and analyses that address the context and scope of energy transport issues and their relationship to federal land in the Section 368(b) states. Information and data that address the connection between current and future energy transportation and federal lands within the Section 368(b) states could assist the Agencies with future land use management planning, while also providing background data, analyses, and context for potential future actions that might be undertaken under Section 368(b), if a need is identified. In addition, the availability of more accessible information on energy transport and use will provide the public and interested stakeholders with appropriate background information to participate in future energy planning activities that might occur on these federal lands.

Because Congress directed the Agencies to first identify corridors, this report summarizes current energy transportation infrastructure on federal lands and the forces that are driving future needs for energy transportation corridors and infrastructure in the 37 contiguous Section 368(b) eastern states (eastern states or lower 368(b) states). The States of Alaska and Hawaii are not connected to the electricity transmission grid in the eastern states and have federal land characteristics and energy transportation issues that are significantly different from those shared among the contiguous eastern states. Because Alaska and Hawaii represent neither the federal land composition nor the significance of energy transport issues in the eastern states, Alaska and Hawaii are generally excluded when summary statements are presented in this report about the characteristics of federal land or energy transportation issues, unless otherwise noted in the main body of the text.

This report uses publically available information to quantify and characterize land ownership, land use, and energy infrastructure conditions within the 368(b) states. Maps, tables, and figures are used to summarize and help visualize issues and conditions. The report *does not* address the environmental impacts of any energy transportation scenarios, proposed activities or designations, or specific projects or application proposals. The report outlines a number of land use considerations that are typically addressed by the Agencies when they consider land use planning, including updates to existing land use plans. Importantly, the report closely examines the status of current transportation infrastructure on the federal lands in the eastern states. The Agencies, Congress, and the public are provided with a quantitative characterization and assessment of energy transportation infrastructure for local units of Agency-administered federal lands in these states.

This report:

- Presents an overview of the location, type, administration, and management of federal lands (in the Section 368(b) states) in order to characterize and quantify the current land uses assigned to these lands, so as to place energy transportation issues within the context of these land uses;

- Presents an inventory of existing energy infrastructure on federal lands in the Section 368(b) states;

- Summarizes current and projected energy transportation needs and issues for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities in order to understand how these trends may influence a need to locate energy transportation infrastructure on federal lands in the Section 368(b) states;

- Provides an overview of regulatory issues and guidelines associated with energy transportation facilities on federal lands within the eastern states; and

- Describes and examines current energy transportation permitting considerations and inter-agency agreements that could facilitate locating energy transportation facilities on federal land in the Section 368(b) states.

1.4 AGENCY MISSIONS: CONSTRAINTS AND OPPORTUNITIES FOR ENERGY TRANSPORTATION ON FEDERAL LAND

Land use planning on federal lands located in the Section 368(b) states is a function of each Agency's core mission (including Agency Services and Bureaus). The core mission is implemented through Agency planning goals and objectives that frame and guide decision making on land use actions at the national, regional, and/or local level. Indeed, core missions are often codified by federal legislation and published regulations, which result in Agency policies and procedures that explicitly direct the suite of possible land uses that can be implemented by Agency decision makers. Therefore, the directives in Section 368(b) must be considered within the context of each Agency's land management responsibilities, goals, policies, and regulations to determine the compatibility or suitability of energy transportation developments on Agency-administered lands. The primary federal agencies with land management responsibilities in the Section 368(b) states are the U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, U.S. Department of Defense, Tennessee Valley Authority, Bureau of Land Management, U.S. Bureau of Reclamation, and U.S. Department of Energy.

1.4.1 U.S. Forest Service

U.S. Forest Service (USFS) authorizing legislation allows for a wide range of land use authorizations, including electric transmission and pipeline infrastructure development. Applications for energy infrastructure development on USFS lands are subject to environmental and land use analysis prior to approval and can be denied for a variety of reasons, including a finding that the use could reasonably be accommodated on non-USFS lands. USFS managers cannot authorize the use of USFS lands solely because they may afford an applicant a lower-cost alternative or less-restrictive location when compared to non-USFS lands.

1.4.2 National Park Service

National Park Service (NPS) lands are managed to protect and enhance nationally important ecological, scenic, recreational, and historic locations. Because of the importance the NPS places on protecting NPS lands from development activities, these lands are not generally available for the installation of new major electrical transmission infrastructure or pipeline infrastructure development. Many of the existing transmission and pipeline systems located within NPS units (individual National Parks, National Monuments, trails, or recreation areas) in the Section 368(b) states were in place at the time an NPS unit was created, and many of these energy infrastructure developments are located and operated within easements that have been granted to a utility. The continued use of these easements is defined by the terms of the easement between the utility and the federal government. Although both transmission and pipeline systems are located on NPS-administered lands, the NPS does not have authority to approve pipelines on NPS lands; existing pipelines have either been approved by Congress or were already operating at the time a park unit was established. However, the NPS does have authority to approve electrical transmission lines under certain circumstances.

1.4.3 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the lands that are included in the National Wildlife Refuge System (NWRS), which was created to set aside lands and waters to conserve a wide variety of fish, wildlife, and plant species. Individual USFWS refuges are not generally available for installation of major electric or pipeline transmission systems, although the Secretary of the Interior may permit such use whenever he determines that such uses are compatible with the purposes for which these refuges were established. The USFWS has application requirements that must meet strict standards under *appropriate use* criteria of refuge lands, and the USFWS applies a *compatibility standard* on every application for a use permit on refuge lands. If an application for an energy infrastructure project cannot be certified as compatible with the purposes for which a refuge unit was established, it cannot be granted without authorization by Congress.

1.4.4 U.S. Department of Defense

U.S. Department of Defense (DOD)-administered lands are used principally (1) to provide basing and training sites for the military services and (2) as part of civil works projects such as flood control and navigation. The DOD does not have a mandate to provide lands for electrical or pipeline transmission infrastructure. Individual applications to use military lands for energy transportation infrastructure would usually be analyzed and vetted at the installation level with oversight at higher command levels in each service (Army, Air Force, Navy, or Marines). The U.S. Army Corps of Engineers (USACE) administers lands that incorporate civil works projects developed and managed by the USACE, and these lands are frequently committed to recreation, wildlife, port construction, and project operations functions. However, these lands may be available for location of energy transmission infrastructure if the use is not inconsistent with the purposes for which the land was acquired for each civil works project.

1.4.5 Tennessee Valley Authority

The Tennessee Valley Authority (TVA) operates hydroelectric, coal, and nuclear power generating stations only within the TVA region located within the seven southeastern states. The lands managed by the TVA around reservoirs frequently border private lands and are generally managed for public recreation opportunities or providing fish and wildlife habitat. Because the TVA produces and distributes electricity in the TVA region, energy infrastructure development, including energy transportation projects, would likely be managed and controlled directly by the TVA.

1.4.6 Bureau of Land Management

The Bureau of Land Management (BLM), like the USFS, is a multiple-use agency with a mandate to manage public lands for a wide array of uses, and it has full authority to authorize electrical and pipeline transmission systems consistent with the direction provided in its land use plans. While the BLM manages more land than any other federal agency, BLM-administered lands are found almost exclusively in the 11 contiguous western states and Alaska (see Section 1.5). Where these lands exist in the eastern states and where they have not been committed for other uses through the land use planning process, they could be available for energy transportation infrastructure.

1.4.7 U.S. Bureau of Reclamation

The U.S. Bureau of Reclamation (USBR) is a water management agency that has developed reservoirs and water systems throughout the western states to provide water supply for municipal, industrial, and agricultural uses; flood control; recreation; and hydroelectric power. The USBR-managed lands in the Section 368(b) study area are located in the westernmost tier of six states in the Section 368(b) study area. The USBR has the authority to authorize electric and pipeline transmission facilities on USBR lands. Consideration of applications to use USBR-administered land, facilities, or water bodies is discretionary, and the USBR retains the right to refuse to authorize any use that may be incompatible with the authorized purposes of projects or interferes with operations.

1.4.8 U.S. Department of Energy

DOE maintains several large reservations within the eastern states that support civilian and defense nuclear research, as well as civilian basic and applied scientific research and development activities. These sites do support some electrical and natural gas pipeline facilities, but due to current and past uses, are generally not suited for developing new utility-scale transmission infrastructure.

1.5 SUMMARY CHARACTERISTICS OF FEDERAL LAND WITHIN THE SECTION 368(B) STATES

Federal lands located within the Section 368(b) states represent a relatively small percentage of total land area in these states (Table 1.1). The State of Alaska is an exception to this statement, with almost 60% of the land area controlled by the federal government, including large areas of land administered by the BLM, NPS, and USFWS. The State of Hawaii has approximately 12.5% of federal land, primarily managed by the DOD and NPS.

Figure 1.1 shows the distribution of federal lands in the Section 368(b) states, and some patterns emerge in the eastern states:

- USFS lands are located primarily in the Upper Great Lakes states; in the southeastern United States along the spine of the Appalachian Mountains, with smaller amounts of national forest lands located in Missouri; along the Ohio River Valley; and within the valley and ridge areas of western Pennsylvania.

- NPS lands are geographically diverse, but land areas are relatively small, compared to some of the large NPS

TABLE 1.1 Amount of Federal Land in the Section 368(b) States

	Land Area of the Section 368(b) States (mi^2)[b]			
	Conterminous 368(b) States	Alaska	Hawaii	All 368(b) States
Non-Federal Land	1,542,587	244,608	5,586	1,792,782
Federal Land[a]	80,167	336,444	797	417,408
USFS	44,358	37,675	0	82,034
NPS	9,668	85,440	624	95,732
BLM	529	79,337	0	79,866
USFWS	10,128	131,108	70	141,307
DOD	13,210	2,884	103	16,197
TVA	1,261	0	0	1,261
USBR	472	0	0	472
DOE	457	0	0	457
AG RES	84	0	0	84

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] To convert mi^2 to km^2, multiply by 2.590.

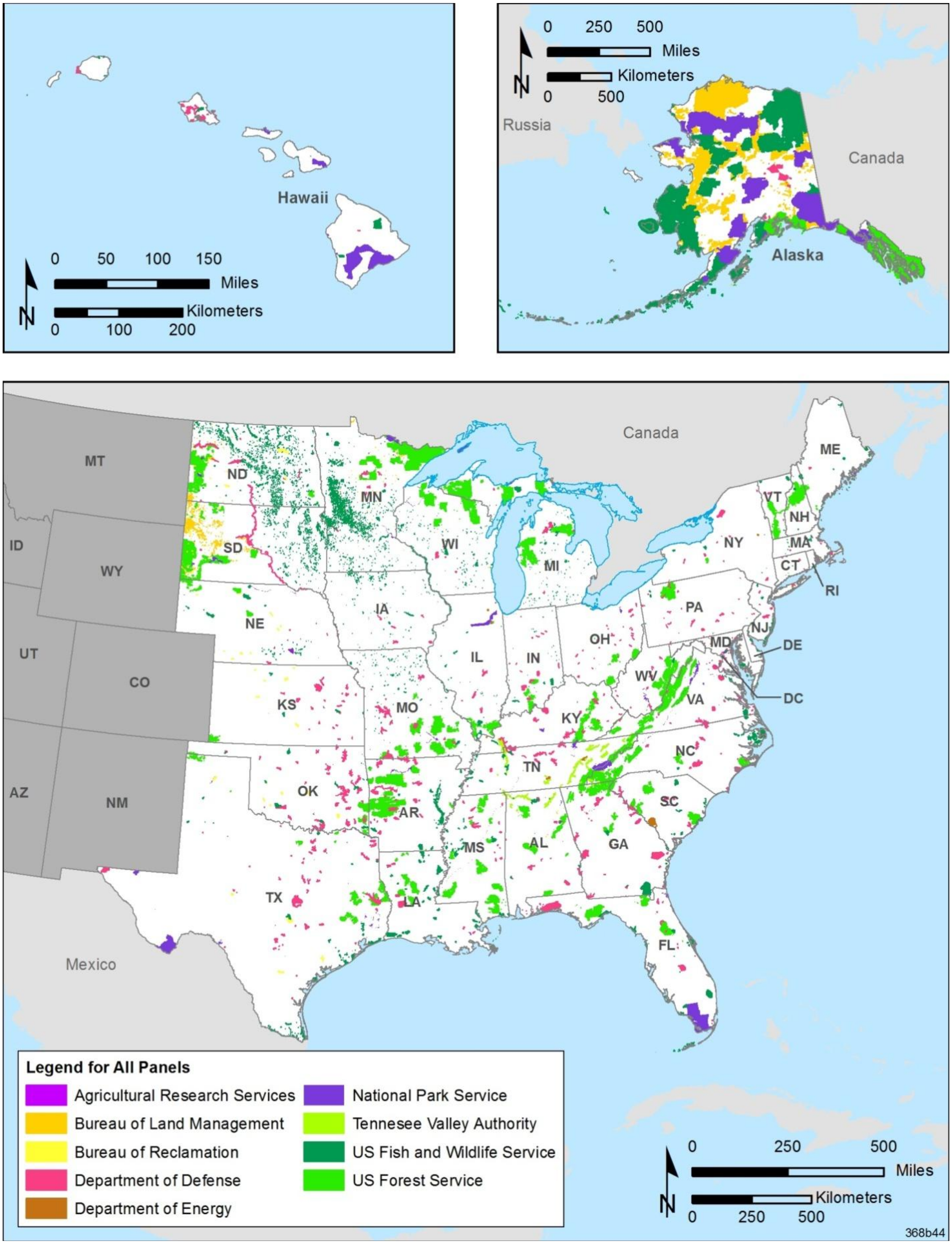

FIGURE 1.1 Federal Lands Located within the Section 368(b) States

land areas found in the 11 western states. NPS lands in the eastern states are characterized by trails, historic locations, and significant ecological and/or recreational use areas.

- USFWS wildlife refuges are located throughout the eastern states. Many of these refuges include important wetland areas and riparian ecosystems and provide significant habitat for migrating bird populations. USFWS lands often include the largest non-fragmented, protected areas for wildlife found in the eastern states.

- DOD lands are also located throughout the eastern states, with large installations located along coastal areas in the mid-Atlantic and southeastern states.

- The TVA, USBR, and USACE administer lands along river systems in the Appalachian and southeastern states, as well as along the Ohio and Mississippi Rivers. These lands buffer hydropower reservoirs, as well as navigation and flood control structures, and are generally managed to provide recreational opportunities.

In contrast to the 11 western states, there are limited areas of public land administered by the BLM in the eastern states (Table 1.1 and Figure 1.1). Although BLM-administered public lands are often managed for multiple-use purposes, including uses related to energy production and transportation, the lack of BLM-administered lands reduces potential energy transportation opportunities on these lands. Because of its core mission to manage public lands for multiple uses, the BLM has extensive experience in allocating public land for energy transmission (DOE and DOI 2008). The relative scarcity of BLM-administered land in the eastern states limits the proactive role the federal government can play in energy transportation planning and analysis under Section 368(b). In the absence of BLM-administered lands, USFS-administered lands are the largest area of federal land in the eastern states managed for multiple uses (see Section 1.4). The USFS, through its land use planning process, can allocate USFS land for a number of public purposes, including access for energy transportation infrastructure.

Compared to the 11 western states, the spatial distribution of federal lands in the eastern states reveals the location-based challenges for siting corridors on federal land in the Section 368(b) states. For example, a comparison of the four western and eastern states with the largest percentage of federal land area reveals the substantial differences in the amount and type of federal land in the western United States, compared to the eastern United States (Table 1.2). The summary statistics in Table 1.2 clearly show (1) the smaller and more fragmented footprint of federal land in eastern states compared to states in the western United States and (2) the extent of BLM lands in the western states compared to the eastern states. The four western states offer considerable opportunity to implement relatively long corridor segments entirely on federal lands managed for multiple uses (e.g., BLM and USFS). In contrast, the character of federal land ownership in the eastern states indicates that locating long-distance energy transportation infrastructure will be primarily dependent on using available non-federal land.

An examination of USFS-administered lands provides further insight into the spatial and land use issues associated with corridor planning in the eastern states. The national forests in the eastern states comprise more than 44,365 mi^2 (114,905 km^2) of land, but this land is contained in over 11,000 separate parcels[3] that vary in size

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3 Here, a parcel is defined as a contiguous unit of federal land that may also contain embedded non-federal land. Parcels smaller than 1 acre in size in the database have been excluded. Also, since large parcels may have embedded non-federal land, the total area of large parcels is an overestimate of USFS-administered land in large parcels.

TABLE 1.2 Comparison of Type and Percentage of Federal Land in the Western and Eastern States with the Largest Federal Land Percentages

	Total Federal Land Acreage[a]								
State	BLM	USBR	DOD	DOE	USFWS	NPS	USFS	Other	% Federal
Western States with Greatest Federal Land Percentage									
Nevada	47,268,706	548,795	2,424,079	860,776	2,378,104	670,867	5,771,806	0	84.69
Utah	22,630,737	183,639	1,840,670	0	101,526	1,975,700	8,097,562	0	64.10
Idaho	11,677,334	82,572	219,759	574,166	90,386	527,413	20,412,625	30,347	62.85
Oregon	15,699,347	44,975	127,818	0	589,765	197,892	15,655,026	0	52.08
Eastern States with Greatest Federal Land Acreage									
Florida	307	0	709,319	0	777,233	2,643,670	1,178,673	0	14.65
New Hampshire	0	0	532	0	22,853	143	746,910	0	12.99
Michigan	0	0	153,507	0	125,423	695,488	2,844,336	0	10.27
Arkansas	670	0	443,210	0	361,036	103,772	2,581,428	0	10.25

BLM = Bureau of Land Management; USBR = U.S. Bureau of Reclamation; DOD = U.S. Department of Defense; DOE = U.S. Department of Energy; USFWS = U.S. Fish and Wildlife Service; NPS = National Park Service; USFS = U.S. Forest Service; Other = U.S. Department of Agriculture and U.S. General Services Administration.

[a] To convert acres to km^2, multiply by 0.004047.

Source: Reitsma (2009).

from less than 1 to 2,431 mi^2 (3 to 6,296 km^2) (Figure 1.2). USFS lands in the eastern states consist of relatively few large contiguous land areas, and individual national forest units often contain numerous small parcels of federal land intermixed with non-federal land. For example, while national forests such as Mark Twain, Hoosier, Nicolet-Chequamegon, Kisatchie, and Allegheny are relatively large units located in the eastern states, they are made up of numerous small parcels interspersed with non-federal lands. For example, Figure 1.3 shows the heterogeneous spatial pattern of USFS-administered land that comprises the Mark Twain National Forest units.

The heterogeneous ownership patterns impede the USFS in locating corridors on federal lands without affecting a significant number of neighboring non-federal landowners. In addition to the issues of spatial heterogeneity at the individual national forest-unit level, many national forests in the eastern states are separated from other units by hundreds of miles of intervening non-federal land (with the possible exception of the northern lake states and along the spine of the Appalachian Mountains (Figure 1.1). Again, the spatial pattern of USFS land in the eastern states limits the ability of the federal government to develop proactive plans for corridor routing that can influence or expedite energy infrastructure development.

While it is the mission of the USFS to engage in multipurpose land management, the USFS has determined that some USFS land must be managed and utilized for a single value or purpose. Other uses of these lands receive low priority or must closely align with the designated use. These single-purpose lands may be reserved for recreation, wilderness, roadless areas, or unique ecological services or values. For example, Figure 1.4 shows the extent of specially designated areas on USFS-administered lands in parts of the eastern states. Allocating these lands for new or enhanced energy infrastructure would not likely occur under normal land use planning processes. Thus, while the USFS has the opportunity to manage its lands in a multi-use manner, the combination of heterogeneous spatial land holdings and special protected areas impedes the implementation and/or development of connected long-distance corridors.

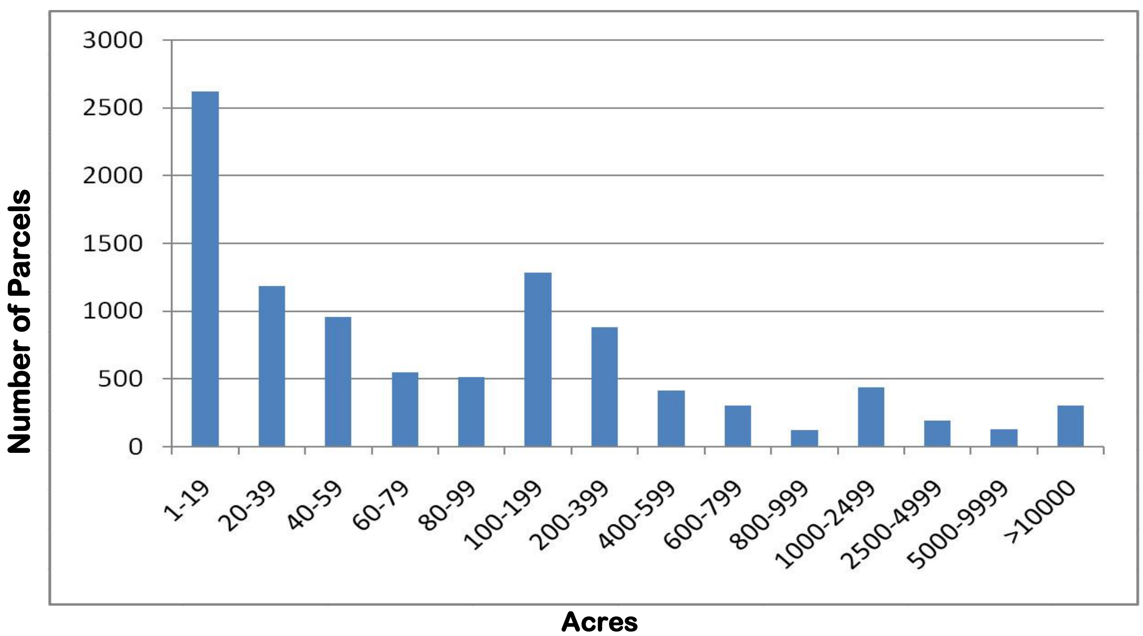


FIGURE 1.2 Size Distribution in Acres of Contiguous USFS Parcels in the Eastern States

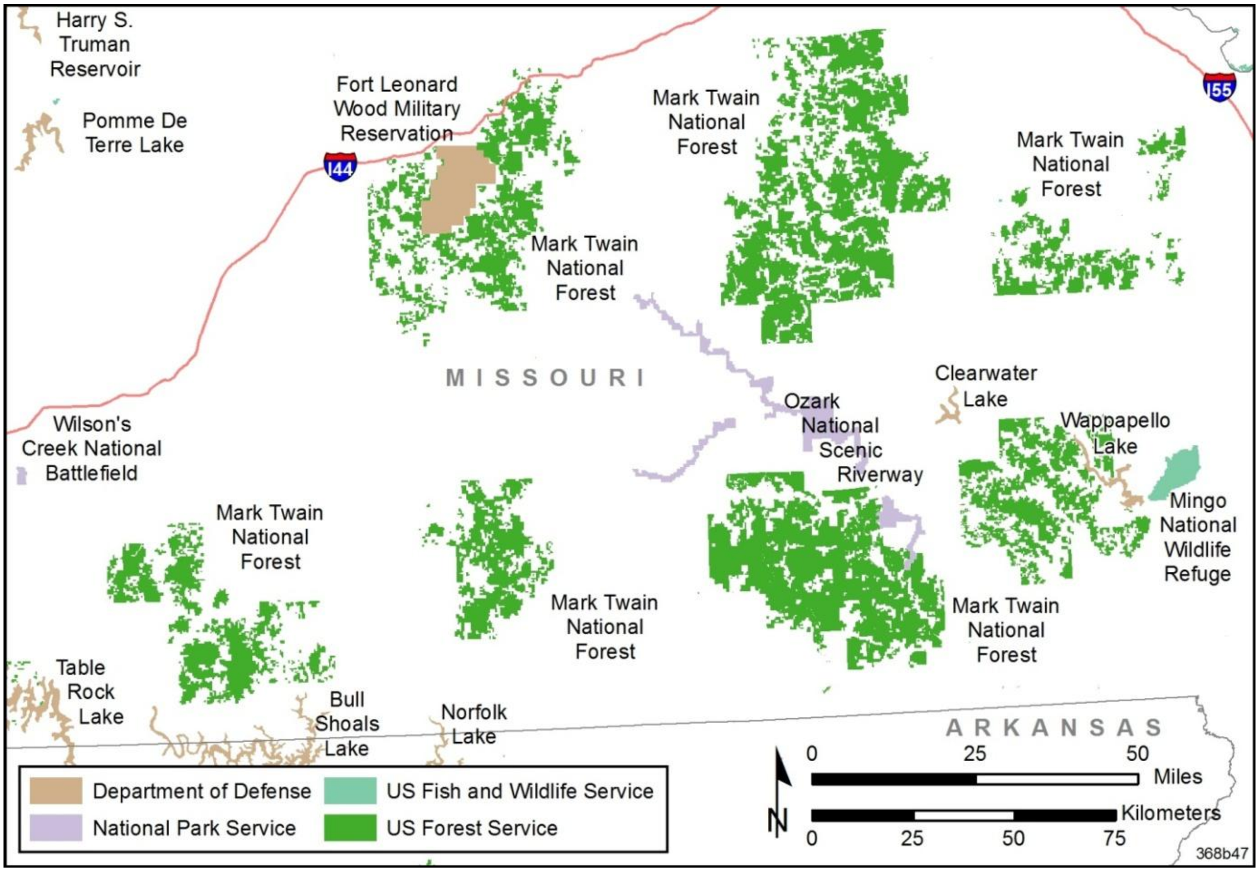


FIGURE 1.3 Mark Twain National Forest Lands in Missouri

1.6 OVERVIEW OF THE ENERGY TRANSPORTATION SECTOR—ELECTRICITY TRANSMISSION, NATURAL GAS, PETROLEUM PRODUCTS, AND HYDROGEN

1.6.1 Electricity Transmission Infrastructure Overview

Electrical transmission infrastructures provide complex networks for moving electrical power between generating sources and demand areas. In the eastern states, approximately 267,000 mi (429,695 km) of transmission lines rated 100 to 1,000 kV provided the major pathways for delivering power in 2008. This represented 73% of the total U.S. transmission capability of 100 kV or higher. The Eastern Interconnection contains approximately 238,362 circuit miles (383,607 km), or 89% of the study area total. The Texas Interconnection contains approximately 28,665 circuit miles (46,132 km), or 11% of the miles of transmission line in the eastern states.

The electrical grid in the eastern states is generally characterized by a high level of connectivity. This level of connectivity contrasts with the less-connected transmission grid systems that are found in the 11 contiguous western states. The increased connectivity in the eastern states is the product of more than 100 years of grid development combined with the close proximities that exist between generation sources and demand centers. The

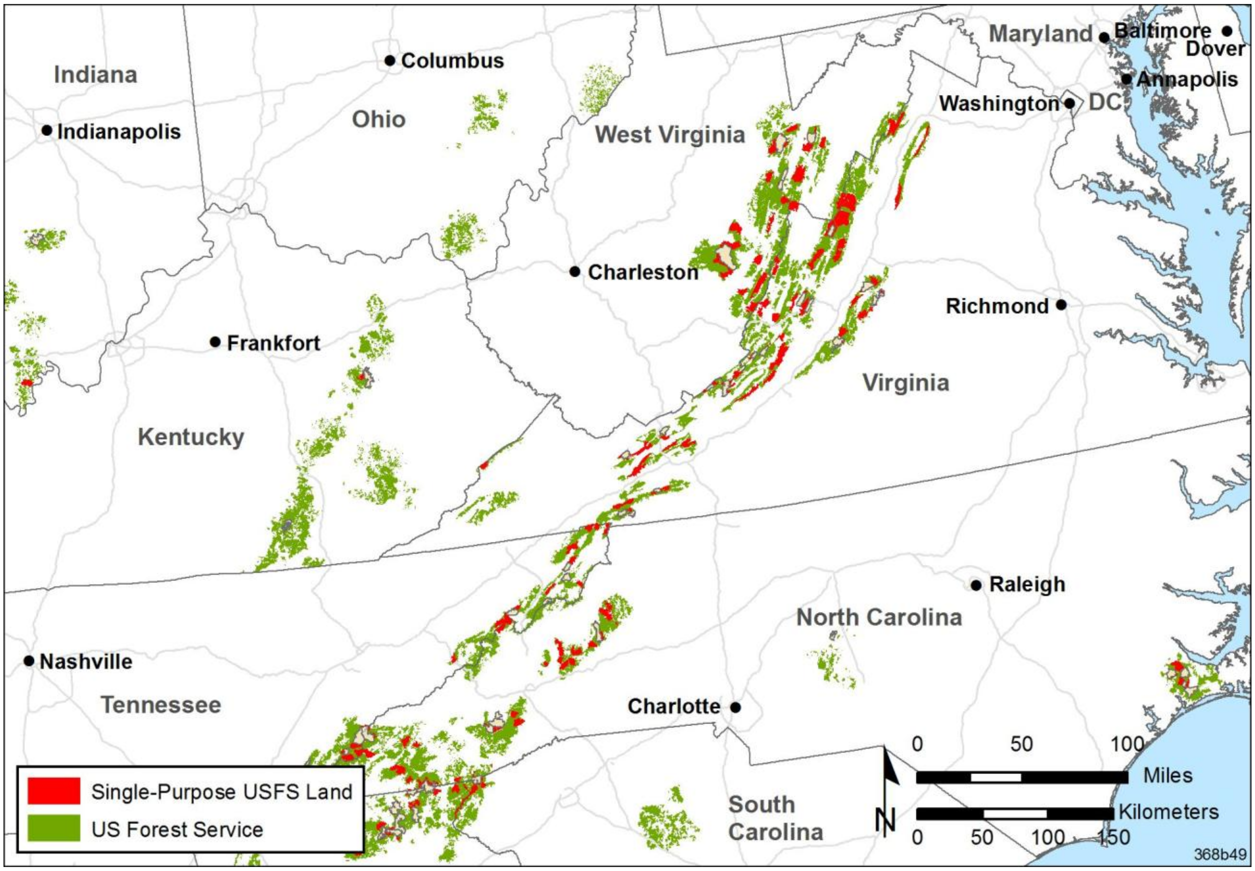
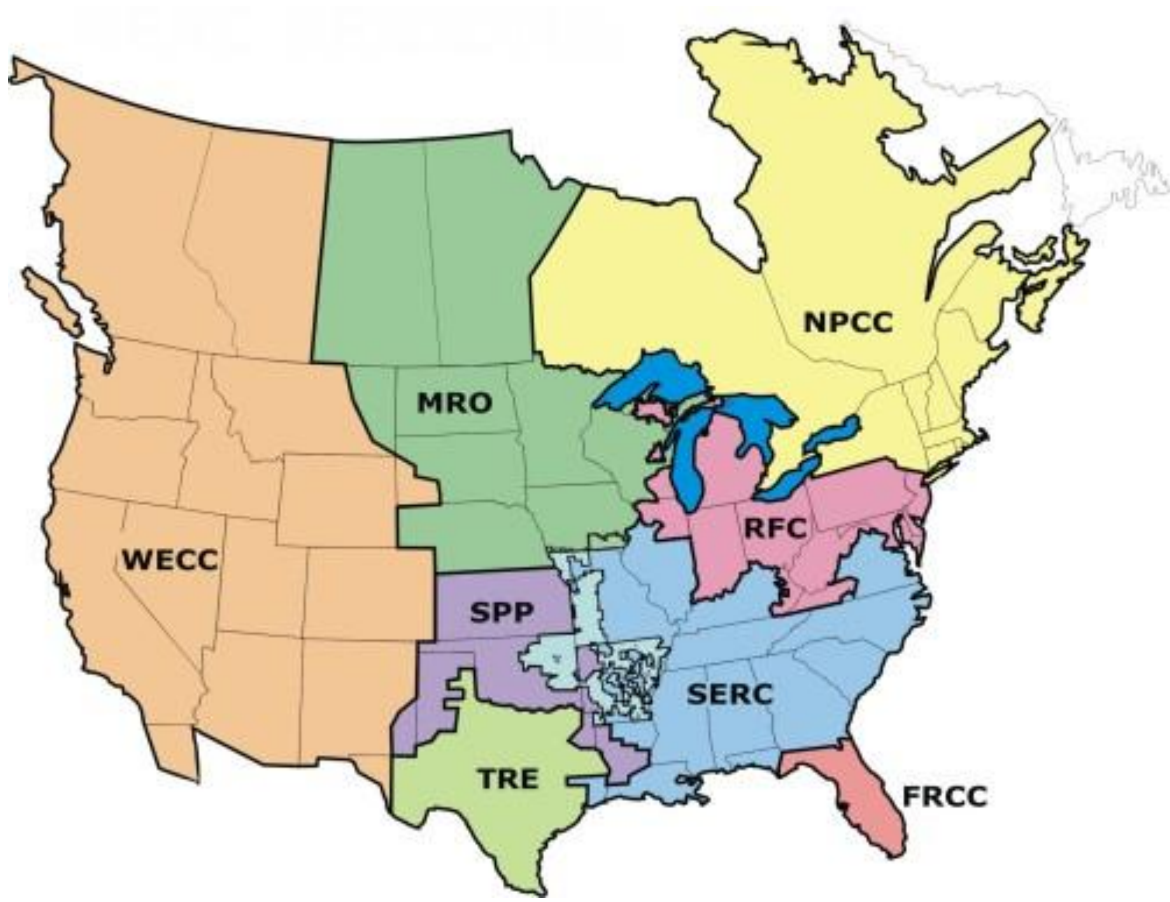


FIGURE 1.4 Single-Purpose USFS-Administered Land in a Portion of the Eastern States (Single-purpose land is highlighted in red.)

high population densities that are common in the eastern states also greatly influenced transmission system development and evolution. Highly interconnected transmission systems are generally more reliable and offer greater flexibility in dispatching the least-expensive generating sources to serve the maximum possible loads. However, highly interconnected grids do require more comprehensive monitoring and control in order to route power as planned while minimizing inadvertent power flows across unintended transmission links. Loosely networked transmission systems, providing limited reliability, are found in Hawaii and Alaska. Some remote locations in Alaska and Hawaii have transmission systems that are radial in their structure and operate at lower voltages more characteristic of distribution systems.

The Regional Entities (REs) representing each of the eight geographic regions of the country that compose the North American Electric Reliability Corporation (NERC) (see Figure 1.5) are responsible for the reliability of the transmission networks under their administrative boundaries and for ensuring compliance with NERC and FERC standards. To satisfy those responsibilities, REs, in collaboration with the independent system operators and other stakeholders, are examining how physical transmission expansion scenarios can resolve existing constraints and accommodate demand growth. In addition, REs and the independent system operators are identifying necessary modifications to existing systems to accommodate greater amounts of power from renewable generating technologies such as wind and solar, many of which are more



FRCC – Florida Reliability Coordinating Council
MRO – Midwest Reliability Organization
NPCC – Northeast Power Coordinating Council
RFC – Reliability*First* Corporation
SERC – SERC Reliability Corporation
SPP – Southwest Power Pool, RE
TRE – Texas Regional Entity
WECC – Western Electricity Coordinating Council

FIGURE 1.5 NERC Regions in the United States (Source: NERC 2010)

remotely located from demand areas compared to traditional generating units (e.g., coal, gas, or nuclear), and which impose unique requirements on transmission systems and their operators. In addition, future transmission systems must adapt with new or enhanced infrastructure to new conditions, such as the intermittent production from renewable energy sources (minute-to-minute, daily, and seasonal variability) and incorporation of "smart grid" technologies.

The eastern states are expected to add more than 16,000 circuit miles (25,750 km) of new 100- to 1,000-kV transmission lines by the year 2018. The Eastern Interconnection accounts for 70% of those ongoing, planned, and conceptual additions (more than 11,745 circuit miles [18,902 km]), and the Texas Interconnection is anticipated to add 4,970 circuit miles (7,998 km) (30% of the eastern states total).

Figure 1.6 shows (1) transmission paths that are currently congested/constrained, (2) transmission pathways that represent proposed additions, and (3) lands administered by the Agencies. The lines in Figure 1.6 have been developed to show very general pathways for constrained segments and the preferred pathways for proposed expansions (as presented by utilities and transmission companies), and

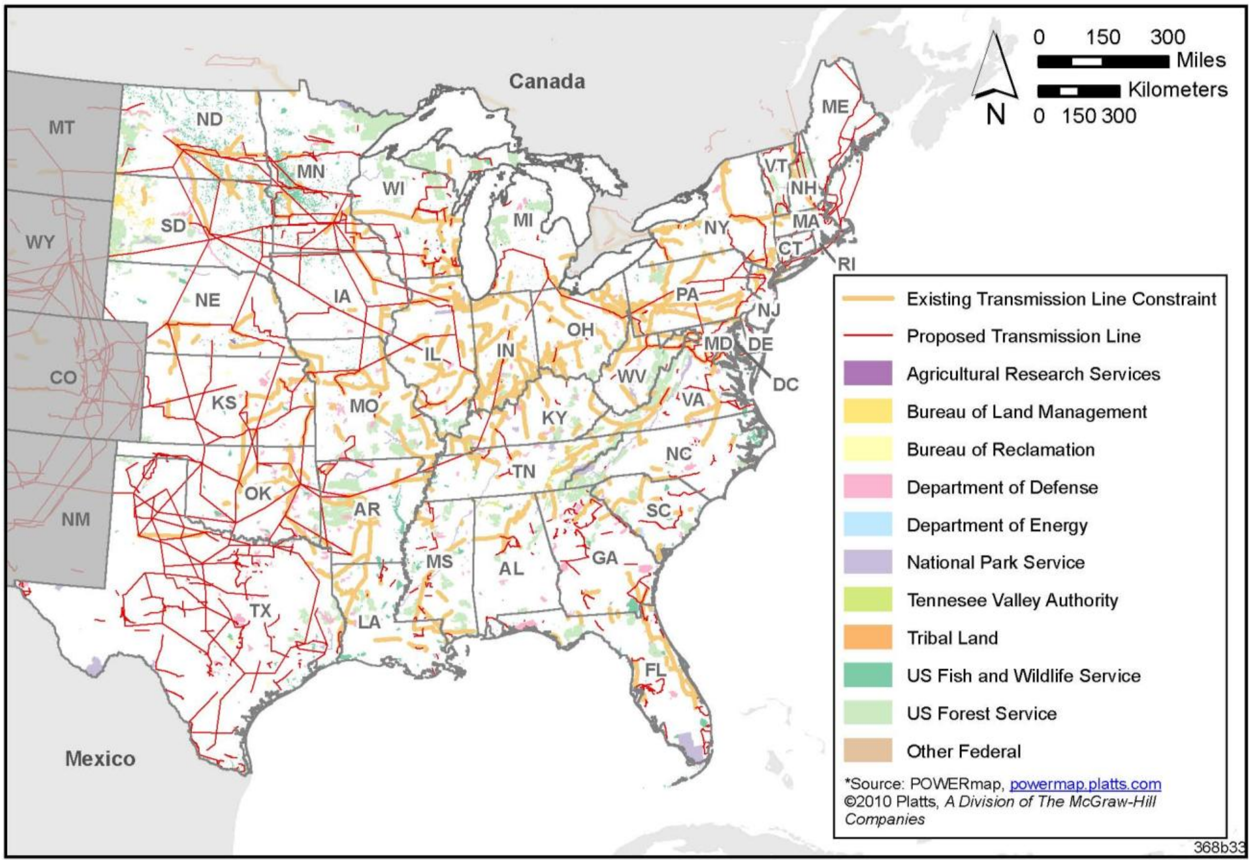


FIGURE 1.6 General Relationship between Federal Lands and Electricity Transmission Constraints and Planned Additions to Long-Distance Transmission (Source: Platts 2010)

these lines should not be interpreted as proposed corridors or ROWs. While congestion on existing lines can sometimes be resolved by adding new connections in other areas (i.e., creating redundant paths between generation and load or introducing new generation sources to service the load), the constrained lines do represent routes where congestion relief is needed (as noted by industry and grid operators). While the pathways for future transmission and their general proximity to federal lands in the eastern states provide context for a possible role for federal land in future transmission, the small parcels of public land in the eastern states, especially compared to western states, illustrate that opportunities for major contiguous transmission corridors on federal land are limited. Importantly, areas where public lands are most available do not coincide with proposed new transmission pathways or areas where transmission development would be most needed in the near term.

1.6.2 Natural Gas Infrastructure Overview

In the United States and Canada, the natural gas transportation infrastructure comprises roughly 38,000 mi (61,155 km) of gathering pipeline, 85 billion cubic feet per day (Bcfd) of natural gas processing capacity, 350,000 mi (563,270 km) of high-pressure transmission pipeline, 4.5 trillion cubic feet (Tcf) of natural gas storage capacity, and 12 Bcfd of liquefied natural gas (LNG) import capacity. The U.S. network includes more than 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points that transfer natural gas throughout the country, as well as

24 hubs that offer additional interconnection opportunities (see Figure 1.7). The transmission pipeline network includes 1,400 compressor stations, as well as 49 import and export points. Additionally, there are 8 LNG import facilities, 100 LNG peaking facilities, and 400 geologic repositories for storage of natural gas. There are 11 primary transportation corridors within the United States, including five transmission lines originating in the producing areas of the southwestern United States, two pipelines that extend from the Rocky Mountain region, and four routes that enter the country from Canada.

Both the Interstate Natural Gas Association of America (INGAA) and DOE's Energy Information Administration (EIA) project growth in natural gas demand, with the majority being the result of increased reliance on natural gas for electricity production. The EIA also projects increased demand in the residential, commercial, and industrial sectors. To accommodate projected steady growth in demand in all sectors, INGAA estimates that approximately 80% of expenditures from 2009 to 2030 will go toward infrastructure expansions and upgrades. The western and northeastern regions will continue to consume, but will account for only 13 to 15% of projected incremental pipeline construction through 2030.

Projected growth in natural gas consumption has an important but relatively small influence on future natural gas pipeline infrastructure investments and expansion when compared to the influence that exploitation of new resources will have. Gas resources in mature basins in the Gulf of Mexico, the midcontinent, western Canada, and the Rockies are the current primary resources supplying the primary interstate

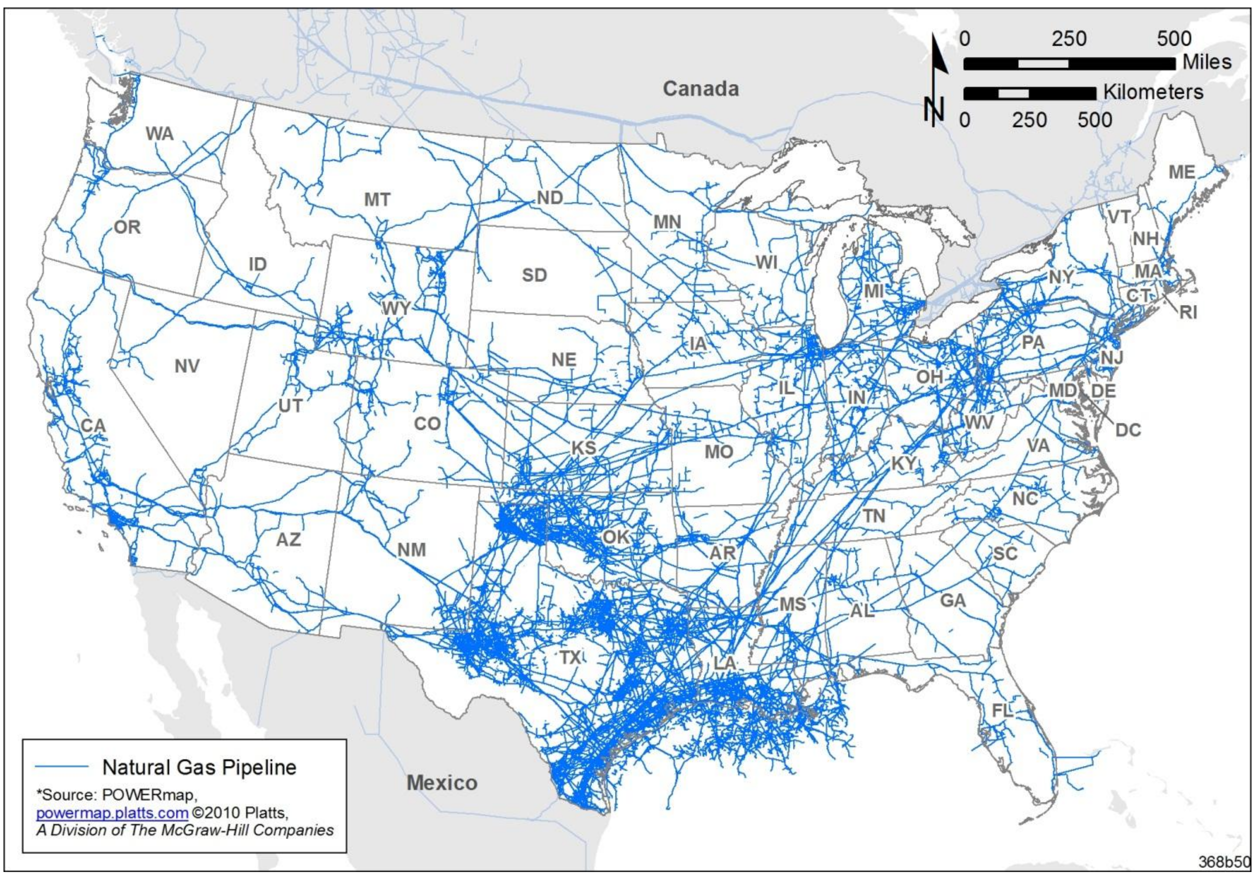


FIGURE 1.7 U.S. Natural Gas Pipeline Network, 2009 (Source: EIA 2009a)

pipeline network. While those resource basins and the pipeline infrastructures that support them will continue to play critical roles in meeting demand, the southwestern and central regions will experience the greatest infrastructure expansions, accounting for as much as 45% of the total projected expansions in supply infrastructure, while accounting for only 23% of the projected growth in national consumption. Facilitated by advancements in recovery technologies, the natural gas resource portfolio is expected to evolve to include increased contributions from unconventional sources, including LNG, coal bed methane, shale gas, tight sands methane, oil field methane, and increased exports from Canada and the Middle East. That evolving resource portfolio will itself precipitate additional physical expansions of the pipeline infrastructure to connect those new resources to existing or rapidly expanding demand centers.

1.6.3 Crude Oil and Petroleum Product Infrastructure Development Overview

Pipelines are the primary transportation mode for moving crude oils from source areas to refineries, and petroleum distillate fuels and petrochemical feedstock from refineries to their points of consumption. The crude oil pipeline infrastructure is separate from the infrastructure that delivers petroleum distillate fuels and products. Crude oil pipelines are categorized as either gathering lines or trunk lines. There are approximately 55,000 mi (88,514 km) of crude oil trunk lines and as many as 40,000 mi (64,374 km) of gathering lines in the United States. Crude oil gathering lines are located primarily in the oil-producing regions of Texas, Oklahoma, Louisiana, and Wyoming, and in offshore locations connecting offshore oil rigs with land-based refineries. There are approximately 95,000 mi (152,889 km) of product pipelines in the United States that transport petrochemical feedstock and refined consumer products such as gasoline, aviation turbine fuel, diesel fuel, and home heating oil. As with crude oil, the same pipeline segments can be used to transport various refined products in batch sequence. Petroleum product pipelines typically originate at or near refineries and terminate at tank farms or distribution terminals located in retail market areas. Ultimate deliveries to the consumer will often involve truck or rail transport from terminals to points of ultimate consumption.

Projections suggest that U.S. oil demand will remain near its present level through 2035. The total liquid fuels consumption, excluding liquefied petroleum gases (LPG), which is transported in dedicated pipelines, is projected to increase from 17.58 million barrels per day in 2008 to 19.87 million barrels per day in 2035, a modest rate of increase of 0.5% per year. The likely new sources of domestic crude oil will include the Bakken shale oil fields in Montana and North and South Dakota; tar sands in Utah, Alabama, Alaska, California, and Texas; and shale oil deposits in the United States (primarily the Piceance Basin in Colorado and Wyoming). Expanded production of Synthetic Crude (Syncrude) from Canadian tar sands (currently representing about 22% of U.S. daily crude oil imports) is also expected.

While changes in the complexion of the crude oil resource mix is the most influential driver for expansions of the crude oil pipeline infrastructure, changing population demographics and changes in the mix of transportation fuels, including greater penetration by plug-in hybrid or all-electric vehicles and an expanded reliance on biofuels, are likely to be the primary factors precipitating changes that incrementally expand the infrastructure in some areas, while idling existing infrastructures elsewhere. The greatest near-term expansion of the petroleum pipeline infrastructure may involve the construction of three new pipelines (under regulatory review) bringing product from Canadian tar sands fields to U.S. refineries in the Midwest and Texas.

1.6.4 Hydrogen Infrastructure

In the United States, nine million tons of hydrogen are produced each year and used mainly for chemicals, petroleum refining, metals processing, and electronics. Hydrogen is transported between generation points and points of use by short-length pipelines, high-pressure cylinders, heavily insulated tube trailers, and cryogenic tankers, with a small amount shipped by rail or barge. Approximately 370 facilities located in 24 states produce hydrogen as a primary product or by-product. However, the hydrogen interstate pipeline infrastructure needed to support hydrogen fuel distribution in the transportation sector does not now exist.

The high initial capital costs of new pipeline construction, coupled with technological limitations to pipeline transport of hydrogen at economical rates, constitutes a major barrier to expanding hydrogen pipeline delivery infrastructure. Consequently, in the near term, transition to a hydrogen economy can be expected to rely not on an interstate pipeline network; rather, it will likely require on-site production of hydrogen and limited transport by truck and rail. Given the uncertainty of the technological approach to delivering hydrogen, it is not possible to predict where a hydrogen transportation infrastructure will be located.

2 AGENCY PROFILES AND AUTHORITIES

2.1 INTRODUCTION

This chapter includes a brief characterization of the federally managed lands within the Section 368(b) study area and a brief description of the mission and land management authorities of the nine federal land management agencies. Unlike in the western states, where federal agencies manage significant land areas, in the 37 eastern states, federal agencies manage slightly less than 5% of the total land area. Further, it is significant to note that among the federal agencies, the USFS, DOD, USFWS, and the NPS manage about 96.5% of the federal lands in the 37 eastern states; the remaining five agencies—the TVA, BLM, USBR, DOE, and ARS—manage the rest.

In Alaska, federal agencies manage about 58% of the land area of the state; in Hawaii, they manage about 12.5%.

2.2 FEDERAL AGENCIES WITH LARGER LAND AREAS

2.2.1 U.S. Forest Service

The USFS administers more federal land than any other agency in the eastern states, a total of about 44,400 mi^2 (114,996 km^2) of land area in 33 national forests and grasslands. However, USFS-administered lands, known as National Forest System (NFS) lands, make up only about 2.3% of the total land area in the eastern states. About 6,530 mi^2 (16,913 km^2) (about 15%) of this NFS acreage is included in designated wilderness or in roadless areas and is not generally available for siting electrical or pipeline transmission systems. It is also likely many of the NFS units will have some areas designated for uses for which electrical transmission or pipeline corridors would be incompatible, thereby further restricting the amount of land potentially available for energy transportation.

In Alaska, USFS-administered lands are located only in the south and southeastern portions of the state; they include about 37,700 mi^2 (97,643 km^2), which is about 6.4% of the state. Much of this land, however, is classified as wilderness, roadless area, national monument, or other specially designated areas and is not available for siting of transmission or pipeline systems. There are no USFS-managed lands in Hawaii.

Depending on the specific situation, installation of transmission or pipeline systems could be considered an appropriate use of NFS lands, but applications for use are subject to rigorous analysis prior to approval. According to national-level USFS policy, the following must be considered when reviewing requests for use of NFS lands[4]:

- Analysis of the proposed use's conformance with the NFS land and resource management plan[5];
- Environmental analysis of the project proposal; and
- Analysis of the need to use NFS lands.

Applications may be denied because they are found to be:

- Inconsistent with NFS land and resource management plans;
- In conflict with other forest management objectives or applicable federal statutes and regulations; or

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[4] Adapted from *Forest Service Manual 2700*, Sections 2703.1 and 2703.2 (http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsm?2700).

[5] Each National Forest or Grassland has a land and resource management plan.

- Reasonably accommodated on non-NFS lands.

USFS policy further indicates that managers are not to authorize the use of NFS lands just because they afford an applicant a lower cost or less restrictive location when compared with non-NFS lands.

2.2.1.1 Authorities

Title V of the Federal Land Policy and Management Act (FLPMA) authorizes the Secretary of Agriculture to issue permits, leases, or easements to occupy, use, or traverse NFS lands and is the only authority for all forms of use involving generation, transmission, and distribution of electrical energy.

Pursuant to the Act of November 16, 1973 (*United States Code*, Title 30, Chapter 3A, Subchapter 1, Section 185(c)(1) and (2) [30 USC 185(c)(1)and (2)]), which amended Section 28 of the 1920 Mineral Leasing Act, where the surface of all of the federal lands involved in a proposed ROW or permit is under the jurisdiction of one federal agency, the agency head, rather than the Secretary of the Interior (the Secretary), is authorized to grant or renew the ROW or permit for oil and gas pipelines and related facilities. Where the surface of the federal lands involved is administered by the Secretary or by two or more federal agencies, the Secretary is authorized, after consultation with the agencies involved, to grant or renew ROWs or permits through the federal lands involved.

2.2.1.2 Special Use Authorizations

Special Use Authorization (SUA) is the general term used by the USFS to describe an authorization for use of NFS lands. Electrical transmission and pipeline systems would be authorized with an easement, which is one type of SUA that is used for linear ROWs. A ROW conveys a limited and transferable interest in NFS land, generally for long-term uses. Most easements for major electrical transmission or pipeline facilities would have a 50-year term and would include provisions for the revision of terms and conditions at specified intervals. An easement conveys only the rights enumerated in the document. Maintenance activities, including access to the facilities, would normally be included in the easement. Substantial modifications of facilities constructed within an easement (e.g., upgrading electrical conductors to higher capacity, increasing the size of a pipeline) would require the approval of the authorized officer.

In some instances, easements were granted by a landowner prior to the time when the land on which the easement is located was made part of the NFS. In these cases, the easement would be managed consistent with its terms at the time the land was acquired.

2.2.1.3 Land Use Planning

USFS policy is clear and specifies that individual forest land use plans must (1) provide for consideration of transportation and utility corridor designation and utilization; (2) designate and incorporate energy ROW corridors on federal land into the land management plans in accordance with EPAct; and (3) provide for coordination between USFS regions and other federal and state agencies to designate location, alignment, and associated use and occupancy standards for ROWs.[6]

The Jefferson National Forest in Virginia and the Ouachita National Forest in Arkansas and Oklahoma are examples of locations where USFS units have designated corridors as part of the land use planning process.

6 *Forest Service Manual 1900, Planning*, Chapter 1920, Land Management Planning, 1926.15(19) (http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsm?1900!..).

2.2.2 U.S. Department of Defense

Although the DOD is the second largest federal land managing agency in the eastern states in the study area, it manages less than one-third of the area managed by the USFS. The 13,210 mi^2 (34,214 km^2) of DOD-managed lands are used principally (1) to provide basing and training sites for the military services and (2) as part of civil works projects such as flood control and navigation projects. DOD and each of the major services have realty, facilities, or installation offices, and procedures for managing lands under their individual jurisdictions.

The DOD does not have a mandate to provide lands for electrical or pipeline transmission infrastructure although, as shown in Chapter 3 of this report, there are limited electric transmission and pipelines on DOD-managed lands. Where lands are managed to support the military services, it can be assumed that accommodation of transmission or pipeline infrastructure could conflict with the defense purposes for which the lands are being managed, and these lands would be poor candidates to be included in large-scale corridor planning.

In the case of lands around civil works projects managed by the USACE, these lands are frequently committed to recreational, wildlife, port construction, and project operations functions. They also may be available, however, for location of transmission infrastructure if the use is not inconsistent with the purposes for which the land was acquired. These lands are usually linear and narrow in nature and, although they might be crossed by transmission or pipeline corridors, they would not be a factor in large-scale corridor planning.

In Alaska, most DOD-managed lands are located near Fairbanks and Anchorage and are part of large defense installations, but they constitute only about 1% of the total area of the state. DOD-managed lands in Alaska support a very small percentage of electrical transmission and pipeline systems in the state. While DOD is the second largest federal land manager in Hawaii, DOD lands constitute only about 1.6% of the total land in the state and support almost no electrical or pipeline transmission facilities (see Chapter 3).

2.2.3 U.S. Fish and Wildlife Service

In the 37-state study area, the USFWS administers about 10,100 mi^2 (26,159 km^2) of lands contained within the NWRS, which was created to set aside public lands and waters to conserve a wide variety of fish, wildlife, and plant species. The NWRS includes all lands, waters, and interests therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas. NWRS lands constitute about 0.6% of the total land in the study area, making the agency the third largest of the federal land management agencies in the eastern states. The land managed by the USFWS is widespread and includes 534 separate USFWS units in these states.

In Alaska, the USFWS administers about 131,000 mi^2 (339,288 km^2), which represents more than 22% of the total land area in the state and more land than any other federal agency. There are 16 NWRs in the state; almost all are some of the largest in the United States, and several have significant portions of their area designated as wilderness.

In Hawaii, 11 units of the NWRS are administered by the USFWS and make up about 1.1% of the land area of the state. The total land area within these units is about 71 mi^2 (184 km^2).

While small numbers of transmission and pipeline facilities are located in NWRS units, these units are not generally available for construction of major electrical or pipeline transmission systems. In fact, it is USFWS policy to discourage the types of uses generally embodied in ROW requests (USFWS 1993;

paragraph 3.3, Policy). If a ROW cannot be certified as compatible with the purposes for which a unit in the NWRS was established, the ROW cannot be granted without authorization by Congress (50 CFR 29.21(g)). Currently, USFWS-administered lands host a very small percentage of the total infrastructure present in the eastern states (see Chapter 3). The USFWS has requirements for the determination of "appropriate uses" of refuge lands and applies a "compatibility standard" that can be difficult to achieve for applicants seeking to use refuge lands for energy transportation infrastructure. These compatibility standards derive principally from the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997. The compatibility standard was formally applied to lands in Alaska in the Alaska National Interest Lands Conservation Act of 1980.

More detailed information regarding determination of appropriate uses is contained in USFWS Manual 603 FW 1, *Appropriate Refuge Uses* (USFWS 2006). Should a proposed use be found to be appropriate, it must also be found to be "compatible;" the direction for this compatibility determination is found in USFWS Manual 603 FW 2, *Compatibility* (USFWS 2000). It is clear that Congress has set a high bar for non-wildlife uses of NWRS lands, and it is extremely difficult to meet these requirements.

2.2.3.1 Authorities[7]

Pursuant to the National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee),[8] the Secretary may permit the use of, or grant easements in, over, across, upon, through, or under any areas within the NWRS whenever he/she determines such uses to be compatible with the purposes for which these areas were established. The permitting requirements and conditions are set forth in 50 CFR Part 29.[9] In addition to the general ROW regulations at 50 CFR Part 29, Title XI of the Alaska National Interests Lands Conservation Act (16 USC 3161 et seq.) governs the process for granting ROWs for transportation and utility systems through NWRs in Alaska.

The USFWS requires applicants to obtain permits for uses on easement areas (e.g., waterfowl production areas) administered by the USFWS if the proposed activities may affect the property interest acquired by the United States. The USFWS Regional Director may grant special use permits to owners of land on which the USFWS has an easement, or to third parties with the owner's agreement, upon determination that the use is compatible. If the USFWS determines that the requested use will not affect the United States' interest, then the Regional Director will issue a letter of non-objection.

USFWS guidance on issuance of ROW permits is also found in 340 FW 3, *Rights-of-Way and Road Closings* (USFWS 1993). All permit applications are subject to NEPA and NHPA compliance analysis.

Pursuant to the Act of November 16, 1973 (30 USC 185(c)(1) and (2)), which amended Section 28 of the 1920 Mineral Leasing Act, where the surface of all of the federal lands involved in a proposed ROW or permit is under the jurisdiction of one federal agency, the agency head, rather than the Secretary, is authorized to grant or renew the ROW or permit for oil and gas pipelines and related facilities. Where the surface of the federal lands involved is administered by the Secretary or by two or more federal agencies, the Secretary is authorized, after consultation with the agencies involved, to grant or renew ROWs or

7 MacCall (2010).

8 Available at http://www.fws.gov/refuges/policiesandbudget/16USCSec668dd.html.

9 Available at http://www.access.gpo.gov/nara/cfr/waisidx_09/50cfr29_09.html.

permits through the federal lands involved (30 USC 185(c)(1) and (2)).

2.2.4 National Park Service

In the 37 eastern states, the NPS manages approximately 9,970 mi^2 (25,822 km^2) of land, which constitutes 0.6% of the total land area in these states. Most NPS units are very small, although there are some notable exceptions, such as the Everglades, Great Smoky Mountains, and Big Bend National Parks. In addition, there are some very long, linear park units such as the Blue Ridge Parkway (469 mi [755 km]), Saint Croix National Scenic Riverway (255 mi [410 km]), and Natchez Trace Parkway (440 mi [708 km]). Throughout the study area, there are about 330 NPS units.

In Alaska, the NPS is the second largest federal land manager with about 85,400 mi^2 (221,185 km^2) under management, which constitutes about 14.7% of the land area of the state. There are 36 NPS-managed units in Alaska, and most of them are very large and well-blocked. Currently, there are no major transmission or pipeline systems located on NPS-managed units in Alaska.

The NPS is the largest federal land manager in Hawaii, managing 624 mi^2 (1,616 km^2) of land, which constitutes about 9.7% of the state. As in Alaska, there are currently no major transmission or pipeline systems located on the six NPS-managed units in Hawaii.

For planning purposes, NPS units should not be considered as generally available for installation of major electrical transmission or pipeline systems, although there are both transmission and pipeline systems located on NPS-managed lands (see Chapter 3). The NPS does not have authority to approve pipeline systems within park units. Existing pipelines in park units were either approved by an Act of Congress or in place at the time the park unit was established. Many of the existing transmission and pipeline facilities located within NPS units were in place when the unit was established, and many of these systems are owned by a utility company and located within easements granted by prior landowners. The continued use of these easements is defined by the terms of the easement.

2.2.4.1 Authorities[10]

The most important statutory directive for the NPS is provided by interrelated provisions of the NPS Organic Act of 1916 and the NPS General Authorities Act of 1970, including amendments to the latter law enacted in 1978. The key requirement of these Acts, as amended, is the establishment of the "non-impairment" standard, which provides the basic test for compatibility of proposed uses within all types of NPS-managed units. Impairment of park resources and values may not be allowed by the NPS unless directly and specifically provided for by legislation or by the proclamation establishing the park.

Before approving a proposed action that could lead to an impairment of park resources and values, an NPS decision maker must consider the impacts of the proposed action and determine, in writing, that the activity will not lead to an impairment of park resources and values. In making such a determination, an NPS decision maker must consider the following: (1) any EAs or EISs required by NEPA; (2) consultations required under Section 106 of the NHPA; (3) relevant scientific and scholarly studies; (4) advice or insights offered by subject-matter experts and others who have relevant knowledge or experience; and (5) the results of civic engagement and public involvement activities relating to the decision.

Any new authorization for a utility to cross NPS-managed lands requires a ROW, which is a special park use that allows a utility to pass over,

[10] This discussion was drawn from NPS and DOI (2006).

under, or through NPS property. It can be issued only pursuant to specific statutory authority, and generally only if there is no practicable alternative to the use of NPS lands. A ROW permit issued by the NPS is considered a temporary document and does not convey an interest in the land. The permit is subject to termination for cause or at the discretion of the NPS regional director.

NPS regulations pertaining to the issuance of ROWs are in 36 CFR Part 14; Department of the Interior regulations pertaining to ROWs in Alaska are found in 43 CFR Part 36.

Utility ROWs over lands administered by the NPS are governed by statutory authorities in 16 USC 5 (electrical power transmission and distribution, radio and TV, and other forms of communication facilities) and 16 USC 79 (electrical power, telephone, and water conduits). Once an application for a ROW has been submitted, a compliance analysis must be conducted according to NEPA (usually this would be an EIS), NHPA, and other statutory compliance requirements as appropriate. If the proposed ROW meets the non-impairment standard and is not incompatible with the public interest, a ROW may be issued. ROWs issued under 16 USC 5 or 79 are discretionary and conditional upon a finding by the NPS that the proposed use will not cause unacceptable impacts on park resources, values, or purposes.

2.2.5 Bureau of Land Management

The BLM, like the USFS, is a multiple-use agency with a mandate to manage public lands for a wide array of uses. It has full authority to authorize electrical and pipeline transmission systems consistent with the direction provided in its land use plans. While the BLM manages more land than any other federal agency, those lands are found almost exclusively in the western United States and Alaska. The BLM does manage land in the eastern states, but this land makes up only about 0.03% of the area within these 37 states. While the BLM is the major federal agency involved in permitting both electrical and pipeline transmission systems in the 11 western states, BLM-managed lands in the East are so fragmented and small that these remaining parcels are of no use in utility corridor planning. Where these eastern lands exist and have not been committed for other uses through the land use planning process, they could be available for use for small segments of transmission facilities.

In Alaska, the BLM is the third largest federal land-managing agency and manages about 14% of the land area of the state. BLM-managed land in Alaska has more miles of natural gas and oil pipelines than that of any other federal agency. There are no BLM-managed lands in Hawaii.

2.2.5.1 Authorities

Title V of FLPMA authorizes the Secretary, like the USFS, to issue permits, leases, or easements to occupy, use, or traverse BLM-managed lands. The BLM land use planning guidance also requires that the necessity of establishing electric transmission and pipeline corridors be considered as part of the planning process.

Pursuant to the Act of November 16, 1973 (30 USC 185(c)(1) and (2)), which amended Section 28 of the 1920 Mineral Leasing Act, where the surface of all of the federal lands involved in a proposed ROW or permit is under the jurisdiction of one federal agency, the agency head, rather than the Secretary, is authorized to grant or renew the ROW or permit for oil and gas pipelines and related facilities. Where the surface of the federal lands involved is administered by the Secretary or by two or more federal agencies, the Secretary is authorized to grant or renew ROWs or permits through the federal lands involved after consulting with the agencies involved. The BLM is the agency that would normally be the authorizing agency in this instance (30 USC 185(c)(1) and (2)).

2.3 FEDERAL AGENCIES WITH SMALLER LAND AREAS

2.3.1 Tennessee Valley Authority

The TVA is a government-owned, independent corporation with a unique history and mission. The TVA was established in 1933 to provide navigation, flood control, electricity generation, and economic development in the Tennessee River Valley. It operates hydroelectric, coal, and nuclear power generating stations within its service area in portions of seven southeastern states. The majority of the land managed by the TVA is located along the Tennessee River and its tributaries and makes up about 0.08% of the total federal land in the eastern states. The lands managed by the TVA along the Tennessee River and around numerous reservoirs are largely committed to economic development, providing public recreation opportunities, and developing and maintaining fish and wildlife habitat. TVA-managed lands tend to be linear, and while they might be crossed by transmission or pipeline infrastructure, these lands are generally not situated to play a role in supporting these types of facilities.

TVA-managed lands can be considered for the location of transmission or pipeline corridors, and there are processes in place to review and authorize these types of uses.

2.3.2 U.S. Bureau of Reclamation

The USBR is a water management agency that has developed reservoirs and water systems throughout the West to provide water supply for municipal, industrial, and agricultural uses; flood control; recreation; and hydroelectric power. USBR-managed lands are located in the six states on the western tier of the eastern state study area and constitute about 0.03% of the study area. These lands are generally located around reservoirs the USBR has constructed, and the lands can be considered as sites for electric and pipeline transmission facilities. Consideration of applications to use USBR-managed land, facilities, or water bodies is discretionary, and the agency retains the right to refuse to authorize any use that may be incompatible with the authorized purposes of projects or interferes with USBR's rights or operations. Since these lands are widely spread and because they tend to be concentrated around reservoirs, they are not candidates to be considered for large-scale corridor planning. There are no USBR-managed lands in Alaska or Hawaii.

2.3.3 U.S. Department of Energy

DOE maintains several large reservations within the 37 eastern state study area that have over the years supported extensive nuclear and other types of scientific research and production. These areas constitute about 0.03% of the total area of the 37 states. Well-known DOE sites include the Oak Ridge, Savannah River, and Argonne national laboratories, among others. These sites support some electrical and natural gas pipeline facilities, but because of their widely dispersed locations, the fact that they are usually surrounded by private lands, and the nature of the work performed within these areas, they are not candidates to be considered for large-scale corridor planning. There are no large DOE facilities in either Alaska or Hawaii.

2.3.4 Agricultural Research Service

The land area managed by the Agricultural Research Service (ARS) is miniscule compared with that of the other federal agencies and composes only about 0.005% of the land in the 37 eastern state study area. A large number of research sites are located in the states of the eastern study area, and there are a few sites in Alaska and Hawaii. None of the sites are very large. Because these areas are so small and because of the agricultural research mission for which they were established, these lands are not candidates to be considered for large-scale corridor planning.

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3 ENERGY TRANSPORTATION INFRASTRUCTURE: PRESENT AND FUTURE

3.1 ELECTRIC TRANSMISSION

3.1.1 Current State of the Electric Transmission Infrastructure

The North American electricity grid is often referred to as the world's biggest machine. The North American electric power system provides electricity to 334 million people, has a total electricity demand of 830 GW (830,000 MW), has 211,000 mi (339,572 km) of high-voltage transmission line (230,000 volts and greater), and represents more than $1 trillion (U.S.) worth of assets (NERC 2011).

Many of the components that make up the electric infrastructure were designed with an operating life of 40 to 50 years. As some of these components near 100 years of age, local, state, and federal governments, businesses, utilities, and the public are taking notice of the degrading changes in this critical infrastructure. In an age of modernization where terms such as "green power" and "smart grid" and anticipation of large-scale electric vehicle usage have gained widespread attention, the U.S. power system infrastructure requires significant upgrades to meet the new challenges introduced by advanced technologies and capabilities. The electric infrastructure requires upgrades to maintain its responsiveness to new energy production sources such as wind and solar generation, and new demand requirements such as electric vehicle applications and customer responses to market conditions.

The Eastern Interconnection includes the NERC regions Northeast Power Coordinating Council (NPCC), Reliability*First* Corporation (RFC), Midwest Reliability Organization (MRO), Southwest Power Pool (SPP), SERC Reliability Corporation (SERC), and Florida Reliability Coordinating Council (FRCC) (Figure 3.1). The Eastern Interconnection covers more than 3.4 million mi^2 (8.8 million km^2) in the United States and Canada and serves more than 225 million customers, who consume more than 610 GW in electric demand. The demand of the Eastern Interconnection represents more than 70% of the total demand of the U.S. and Canadian regions reporting to NERC.

The Texas Interconnection is operated by the Electric Reliability Council of Texas (ERCOT),[11] which manages the flow of electric power to 22 million Texas customers and represents 85% of the state's electric load and 75% of the land area of Texas. ERCOT connects 40,000 mi (64,374 km) of transmission lines with more than 550 generation units (ERCOT 2005).

The Hawaiian Electric Company (HECO) and its subsidiaries, Hawaii Electric Light Company and Maui Electric Company, provide electricity for 95% of Hawaii's residents, which represents about 440,000 customers. Established in 1891, HECO remains one of the few locally owned and operated major companies in the state (HECO 2009).

Alaska has more than 200 remote, stand-alone electrical grids that serve smaller towns and villages, and two larger transmission grids that cover southeast Alaska (encompassing the Juneau area in the Alaska Panhandle) and the Railbelt in south-central Alaska. The Railbelt electrical grid follows the Alaska Railroad from Fairbanks through Anchorage to the Kenai

[11] Texas Reliability Entity, Inc. (TRE) was established January 2010 as the successor for the Texas Regional Entity, a division of ERCOT. The transition of authority was expected to occur in late June 2010 but still awaits approvals from NERC and FERC. This report uses the acronym ERCOT loosely to refer to all of the Texas entity and subregion designations.

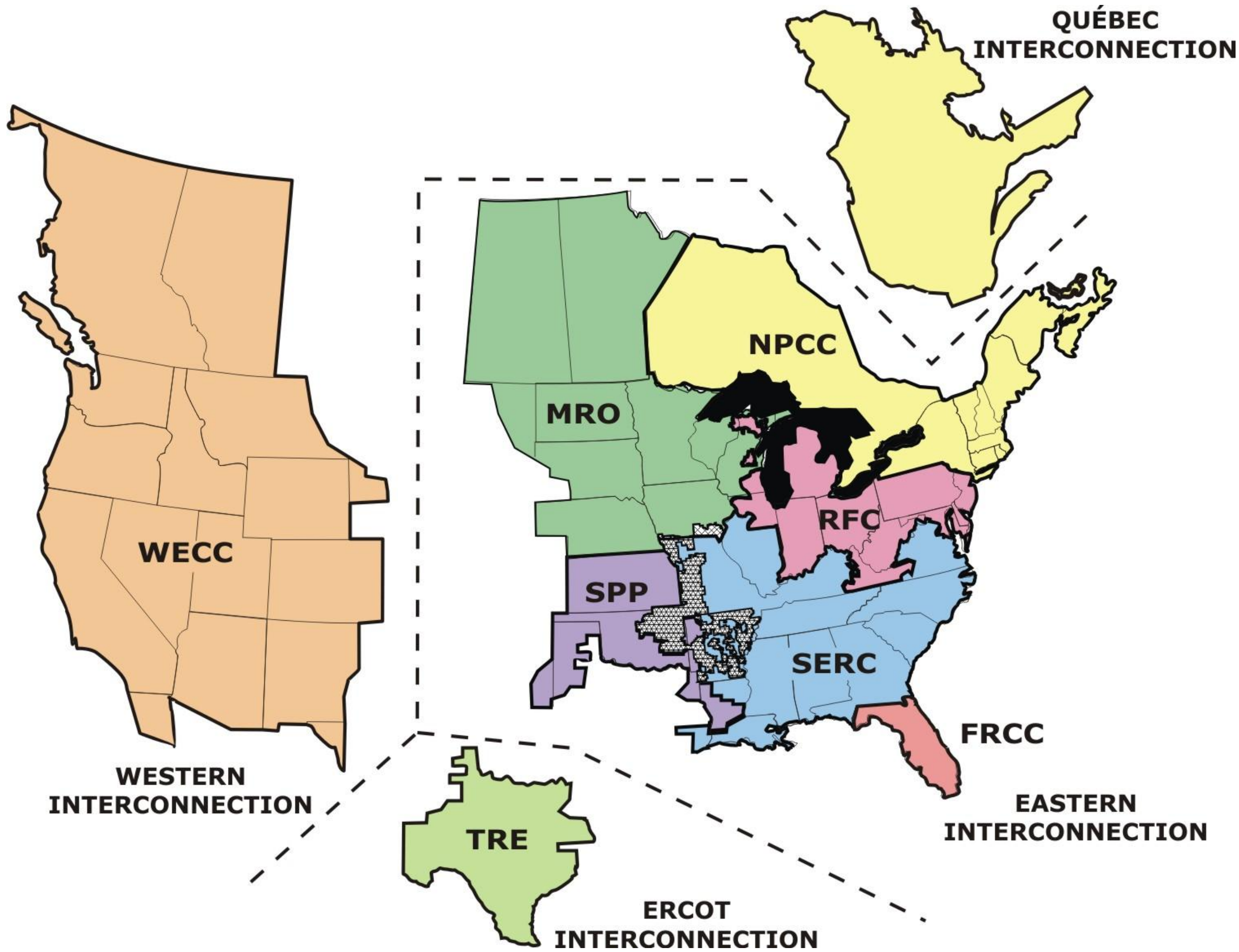

FIGURE 3.1 NERC Interconnections (Source: NERC 2010)

Peninsula and provides electrical energy to approximately 500,000 people.

The transmission systems within the Eastern Interconnection and ERCOT are highly networked in a topography-influenced grid pattern, while those in Hawaii and Alaska are more loosely interconnected and arranged primarily in a radial pattern. Although radial arrangements can easily satisfy point-to-point transfers of power, they have fewer alternative paths for that transfer and, as a result, generally less resilience.

Operating voltage is another distinguishing characteristic of transmission systems. Transmission lines in the Eastern Interconnection operate at voltages up to 1,000 kV and include substantial grid segments at voltages of 765 kV, 500 kV, and 345 kV. In Texas, the primary transmission system operates at 345 kV, with some links rated at 765 kV, and is integrated with lines at 115 kV and 69 kV. Figure 3.3 in Section 3.1.5 provides an overview of the existing transmission grid.

3.1.2 Ongoing Trends and Evolution

Today's grid was primarily designed to move power from centralized supply sources to fixed, predictable loads. A system configured in this way is challenged when called upon to accept input from many distributed energy resources located across the grid. Because resources such as solar and wind power are highly distributed and intermittent, the grid requires integrated monitoring and control, and integration with substation automation to control transmission line energy flows. As contributions from solar and wind generation increase, transmission systems must engage standby capacity to compensate for the variability and interruptions in intermittent generation. Smart grid capabilities simplify control of bi-directional power flows and help monitor, control, and support distributed resources (EAC 2008).

Distributed generation is typically consumer owned and relies on a range of generation technologies that deliver electricity directly to the consumer. On-site photovoltaic panels and small-scale wind turbines are examples of modern distributed generators. Emerging distributed generation resources include geothermal resources, biomass, hydrogen fuel cells, and batteries for energy storage. As the cost of traditional energy sources continues to rise and the cost of distributed generation technologies declines, these new energy resources will become more affordable. Integrating these energy resources with grid operations presents a challenge and will precipitate changes in grid configuration and operation to ensure system reliability (EAC 2008).

The continued increase in installed variable generation, predominately wind, can increase operational challenges. A rapid increase or decrease in wind generation, often referred to as "ramping," can have a significant impact on the power flowing through the bulk power system. In general, the operational impacts of wind generation on regulation and control performance of the bulk power system are still not fully understood. Many wind integration studies in the United States have provided information about the impact of wind on the bulk power system. As concluded by NERC in its latest Long-Term Reliability Study, further study and industry experience will be required to mitigate operational concerns and support large-scale integration of variable generation (NERC 2009).

3.1.3 Existing Transmission Capabilities and Planned Additions

The map in Figure 3.2 shows all of the existing transmission lines currently in operation for the Eastern Interconnect and the Texas Interconnect. This map shows lines of all voltage levels greater than 69 kV currently contained in the Platts POWERmap GIS system (Platts 2010).

As indications of announced plans to strengthen existing transmission infrastructures, the planned additions summarized in Table 3.1 reflect pending projects at various levels of completion. The planned projects are intended to improve overall transmission system reliability, transfer capabilities, and local voltage support. For comparison, Table 3.1 specifies the existing transmission circuit miles by NERC region for 2008, in addition to circuit miles currently under construction, and planned and conceptual additions for 2009 to 2013 and 2014 to 2018.

3.1.4 Overview of Long-Term Demands and Supply Resources

NERC's Long-Term Reliability Assessment report for 2009 is a compilation of the results of short-term (through 2013) and longer-term (through 2018) analyses of electricity supplies and demands by each of the NERC REs. Through 2013, all REs in the Texas and Eastern Interconnections report deliverable (summer peak) resources greater than total anticipated (summer peak) demand with reserve margins ranging anywhere from 12.5 to 28.6%. For 2018, summer peak deliverable resources outpace anticipated summer peak total internal demand in all NERC subregions, but reserve margins fall

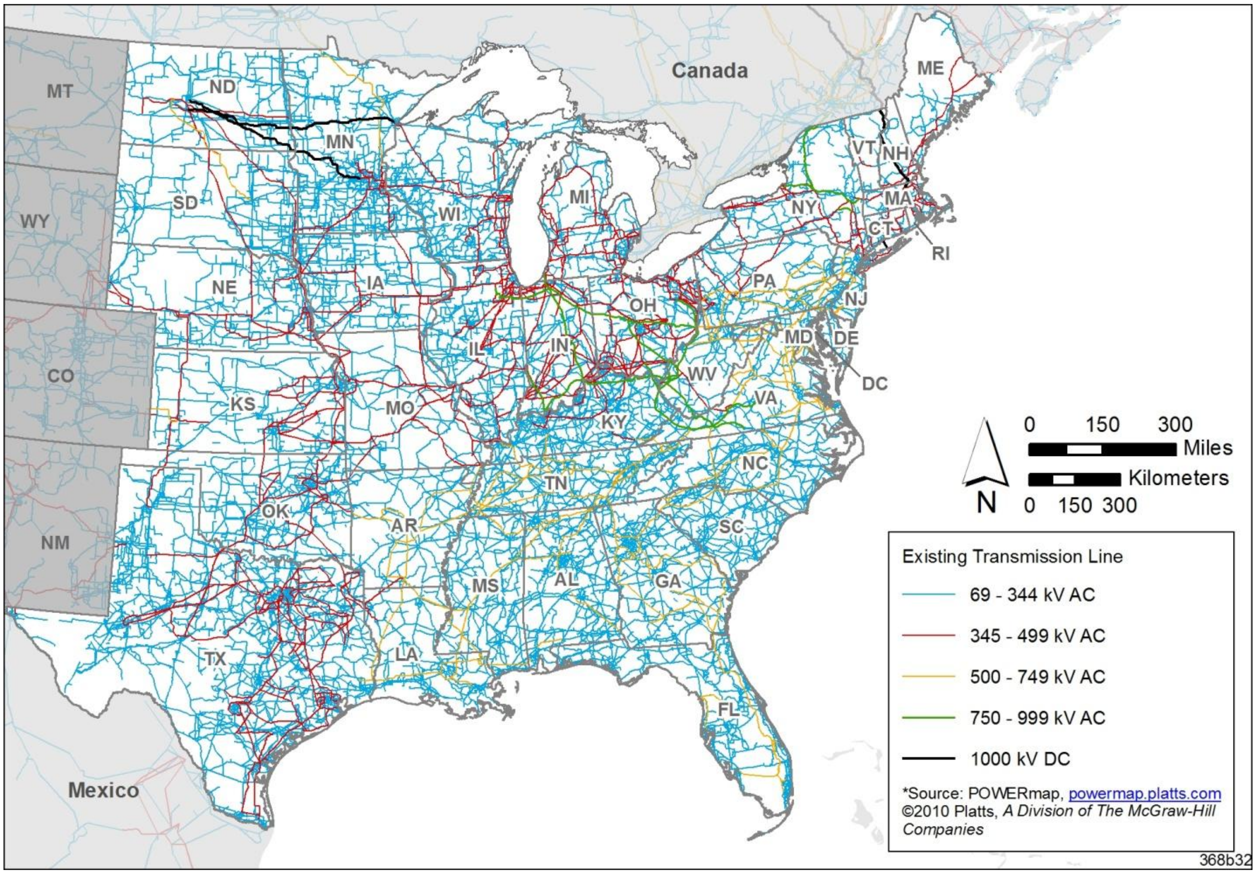

FIGURE 3.2 Existing Transmission Lines for the Eastern and Texas Interconnections (Source: Platts 2010)

to dangerously low levels in some subregions, ranging from 27.0 to 4.1%.[12]

DOE's EIA publishes an Annual Energy Outlook,[13] which provides a longer-term analysis of electricity supply and demand. Because of differences between the geographic areas over which EIA aggregates data and the geographic reaches of NERC REs, NERC and EIA projections are not immediately comparable without introducing some corrections for geographic differences. Nonetheless, reflection on EIA's longer term projections is instructive. In the latest Annual Energy Outlook, EIA notes that despite the downturn of the economy and corresponding slowing of the growth rate of electricity demand, electricity demand is nevertheless expected to increase from 3,873 billion kilowatt-hours in 2008 to 5,021 billion kilowatt-hours in 2035, with growth in all sectors: commercial (42%), residential (24%), and industrial (3%) (EIA 2010). Over the period 2008 to 2035, total electricity generation and deliverable capacity resources are both expected to increase in ERCOT by 0.8% and 0.3%, respectively. Similarly, generation and deliverable capacity are expected to grow in the majority of the Eastern Interconnection REs by rates ranging from 0.3 to 1.4% and 0.3 to 1.3%, respectively. Importantly, EIA also anticipates that the projected growth in demand for electricity in the residential sector is primarily the result of the

12 To ensure grid reliability, most REs attempt to maintain spinning reserves at 15% or greater.

13 All EIA Annual Energy Outlooks can be found at http://www.eia.doe.gov/oiaf/aeo/index.html.

TABLE 3.1 Transmission Plans by Circuit Mile Additions Greater than 100 kV

NERC Interconnection[a]		2008 Existing	Under Construction[e]	2009–2013 Planned Additions[e]	2009–2013 Conceptual Additions[e]	2014–2018 Planned Additions[e]	2014–2018 Conceptual Additions[e]	Total by 2018
ERCOT	–	28,665	–	4,375	137	100	358	33,635
FRCC	–	7,319	143	72	70	197	–	7,801
MRO	–	36,482	618	682	829	597	1,198	40,406
NPCC	–	13,638	53	373	6	17	16	14,103
	New England	2,770	53	352	–	17	16	3,208
	New York	10,868	–	21	6	–	–	10,895
RFC	–	60,074	63	1,246	–	87	–	61,470
SERC	–	97,256	711	1,132	495	331	1,279	101,204
	Central	18,114	222	96	9	–	13	18,454
	Delta	16,431	148	202	–	47	–	16,828
	Gateway	7,751	19	48	56	–	285	8,158
	Southeastern	27,234	277	175	278	156	628	28,748
	VACAR[b]	27,726	64	660	208	128	638	29,424
SPP	–	23,593	205	900	123	114	189	25,123
WECC	–	98,030	3,016	3,283	1,679	1,203	5,521	112,723
	AZ-NM-SNV	15,562	1	659	72	754	1,577	18,625
	CA-MX US	27,004	273	956	765	160	2,508	31,665
	NWPP[c]	43,255	2,415	852	842	152	1,436	48,952
	RMPA[d]	12,209	327	817	–	137	–	13,490
Total-United States		365,058	4,809	12,063	3,338	2,645	8,562	396,474

[a] ERCOT = Electric Reliability Council of Texas; FRCC = Florida Reliability Coordinating Council; MRO = Midwest Reliability Organization; NPCC = Northeast Power Coordinating Council; RFC = Reliability First Corporation; SERC = SERC Reliability Council; SPP = Southwest Power Pool; WECC = Western Electricity Coordinating Council.

[b] VACAR = Virginia and the Carolinas.

[c] NWPP = Northwest Power Pool.

[d] RMPA = Rocky Mountain Power Area.

[e] Transmission Status Categories:

- Under Construction—Construction of the line has begun.
- Planned—Permits have been approved to proceed, design is complete, or needed in order to meet a regulatory requirement.
- Conceptual—A line projected in the transmission plan, a line that is required to meet a NERC TPL Standard or included in a power flow model and cannot be categorized as “Under Construction” or “Planned,” or projected transmission lines that are not “Under Construction” or “Planned.”

Source: NERC (2009).

population moving to warmer climates with concurrent increases in electricity consumption for air conditioning. Such population shifts create imbalances in the existing transmission grid's ability to meet demands at new or expanding load centers.

3.1.5 Transmission System Constraints and Planned Additions

Figure 3.3 provides an overview of existing transmission lines that experience congestion problems. In Figure 3.3, the constrained lines are depicted as dark orange lines. As the figure shows, nearly all parts of the Eastern Interconnection are affected by transmission limitations. The greatest densities of constrained lines cover a wide swath reaching from the north and eastern borders of Texas, extending northeasterly through the Great Lakes region and beyond, through Pennsylvania to the New England region. The Texas Interconnection is portrayed as the largest contiguous area with the smallest number of constrained lines. Observations for each region within the interconnections are described in the following sections.

In addition, for more detailed discussion of transmission constraints, a DOE report published in December 2009 examined congestion issues for the Eastern and Western Interconnections (DOE 2009). The study addresses constraint areas as they related to renewable resource development and transmission adequacy.

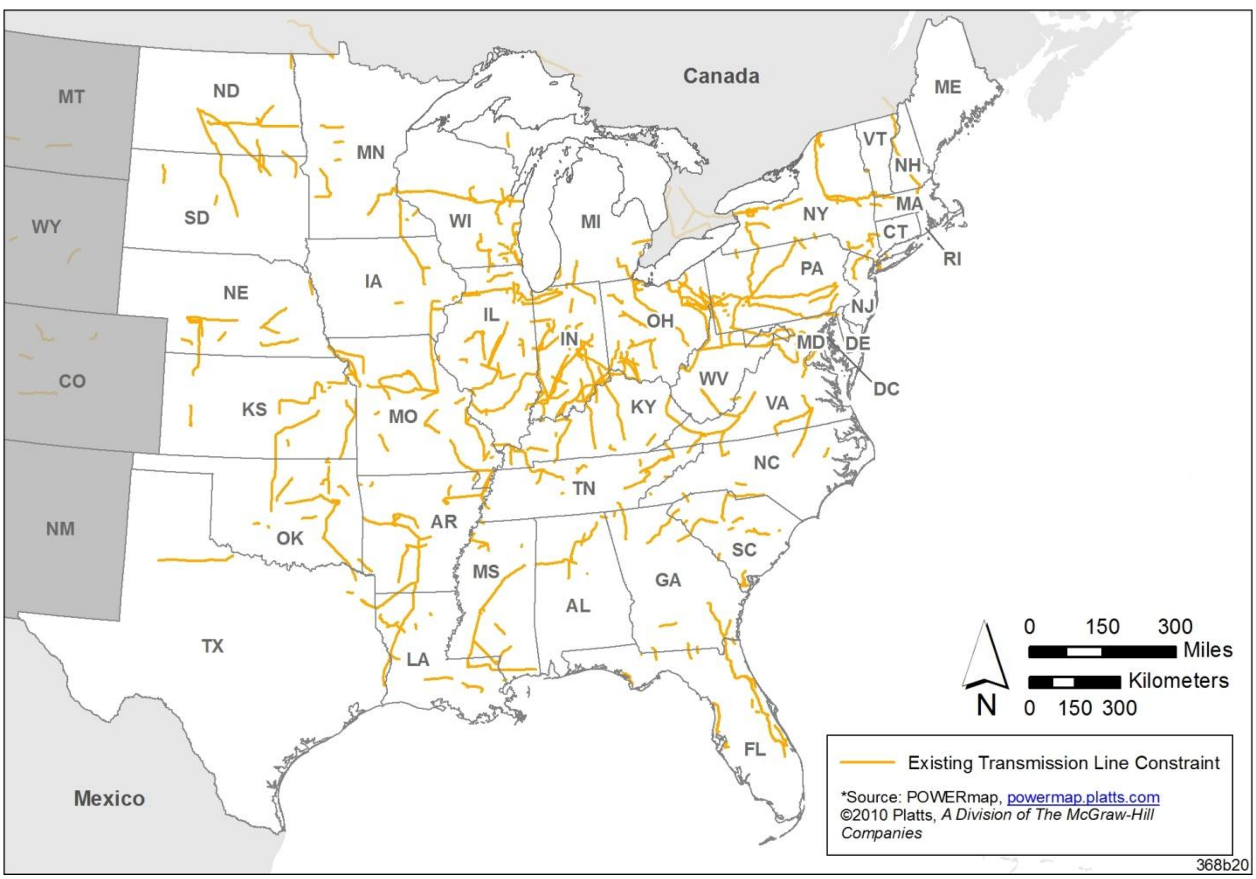

FIGURE 3.3 Transmission Constraints (Source: Platts 2010)

The map in Figure 3.4 illustrates the proposed new transmission line additions that have been announced by utilities and charted in Platts POWERmap (Platts 2010). As noted in the text that follows, many of the proposed transmission line routings are depicted as geographical approximations. These are typically shown as straight line segments connecting the known substations announced for line endpoints. In actual practice, the proposed lines will eventually be routed less directly, as affected by land use, ownership, and acquisition/ROW issues. Overall, the proposed new lines account for approximately 28,000 line-miles (45,061 km) for the Eastern Interconnection and 8,000 line-miles (12,875 km) for the Texas Interconnection (see Platts 2010).

The map in Figure 3.5 shows an overview of constrained transmission lines as mapped against planned transmission line additions. It is important to note that proposed route additions do not necessarily coincide with the pathways of constrained and congested transmission lines.

There are numerous logical explanations for these apparent discrepancies, including the following:

(a) In many cases, the root cause of congestion on a line may be that the line has inadvertently become an overused pathway because there are not more direct connections between generating resources and intended delivery points.

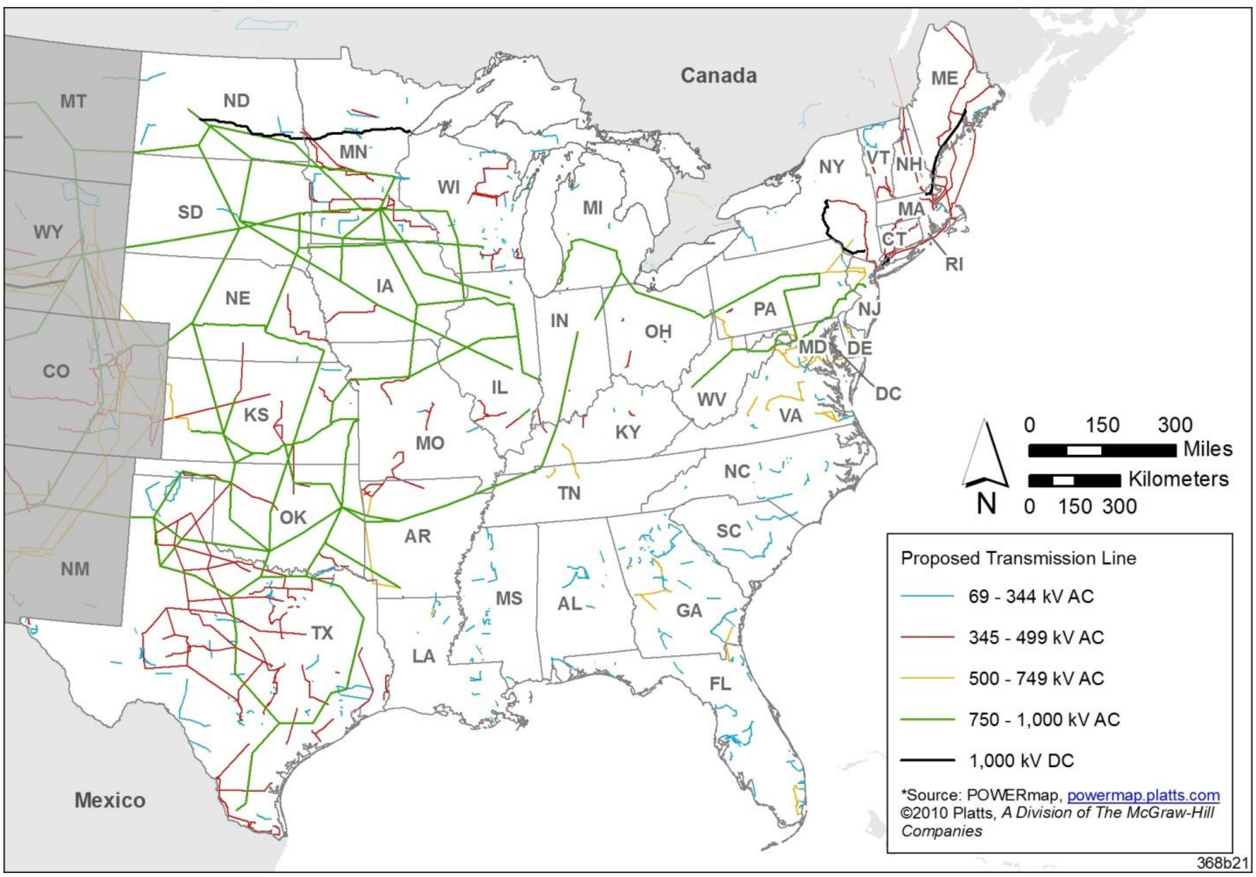

FIGURE 3.4 Proposed Transmission Additions (Source: Platts 2010)

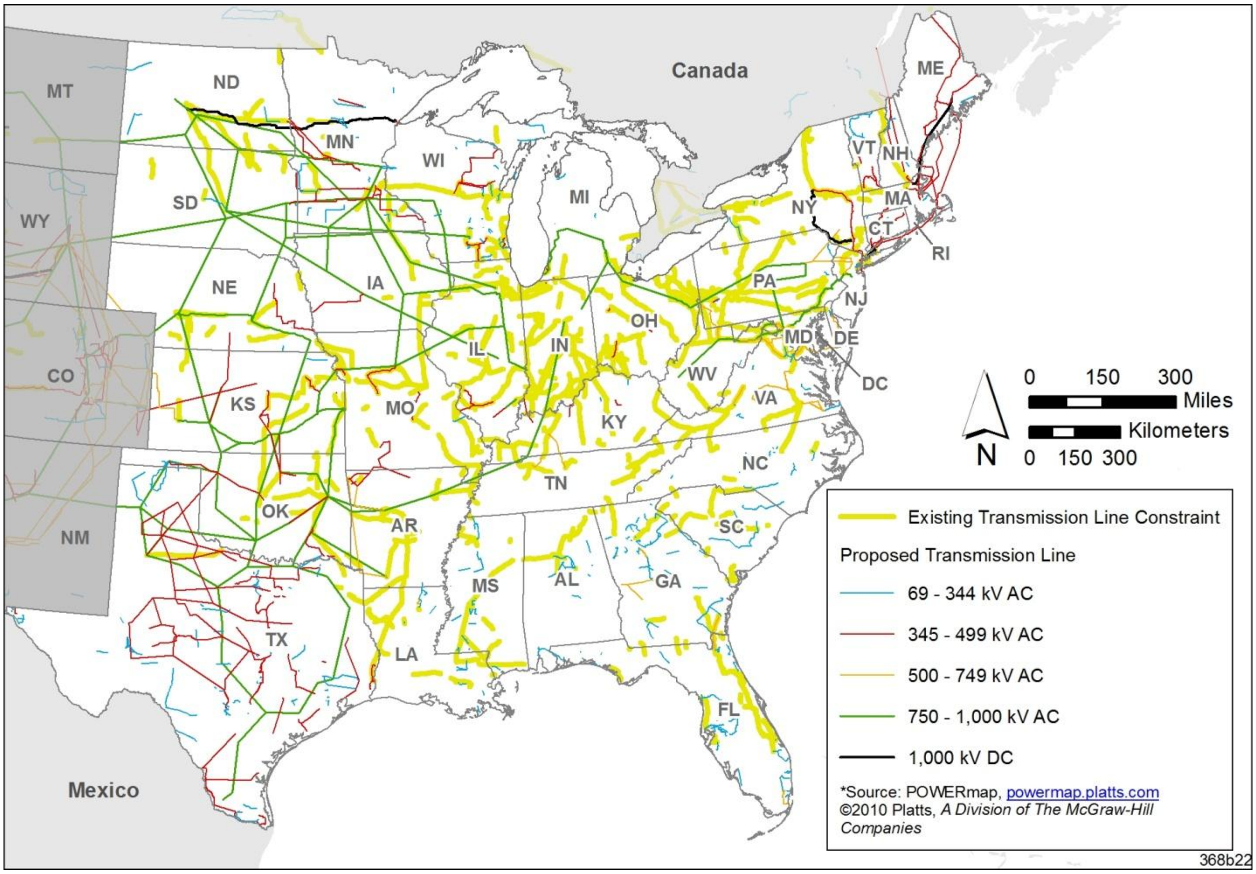

FIGURE 3.5 Transmission Constraints and Planned Additions (Source: Platts 2010)

Thus, more effective solutions may involve development of alternate pathways between the predominant "sources" and "sinks," rather than adding capacity to an overloaded link. Complex modeling tools, known as load flow models, are used by electric system planners and operators to determine the loading level that will occur over each transmission pathway under a wide range of supply and demand conditions. Because electrical power flows through network connections according to laws of physics, and much less according to operator controls, some flows follow unplanned pathways and contribute to inadvertent flows and congested links. The complexity of network configuration and dynamics can routinely obfuscate what would otherwise be more predictable loading patterns for existing lines, and likewise, can make the optimal expansion pathways less than intuitive.

(b) In many cases, "proposed" transmission additions may not be portrayed in Platts POWERmap (Platts 2010) according to exact geographic routes between connection points. Depending on the stage of development and permitting, the proposed lines may be shown as notional connections that illustrate which interconnection points are anticipated, but not the path that will be followed in actual construction of the transmission lines.

(c) Proposed pathways may be designed to address other future trends beyond existing constrained transmission links. For example, as new generating resources (such as renewables) are being developed and new demand centers are projected, new routes may become advantageous for expansion to accommodate the expected future conditions.

(d) Other factors, such as land use, ownership, or exclusion areas, may drive transmission line routings to follow circuitous routes to connect generation and demand nodes.

(e) Existing transmission lines have not been depicted on the maps in this section, because, in general, the full display of linkages is rather dense and causes the maps to be difficult to examine. In some cases, examining the full set of existing lines can shed light on reasons for proposed lines to be located in areas other than constrained lines. However, it was not practical to analyze and display all such instances for this analysis.

(f) Combinations of (a)–(e) and other subtleties associated with transmission design and planning can further weaken the coincidence between congested pathways and proposed new lines.

3.2 NATURAL GAS PIPELINE INFRASTRUCTURE

3.2.1 The Basic Natural Gas Pipeline Infrastructure

The interstate natural gas pipeline infrastructure is a complex system of line pipes, compressor stations, metering stations, valves, and interconnections, all monitored and controlled from centralized control centers using sophisticated supervisory control and data acquisition (SCADA) systems. The INGAA reports that in the United States and Canada there are roughly 38,000 mi (61,155 km) of gathering pipelines,[14] 85 Bcfd of natural gas processing capacity, 350,000 mi (563,270 km) of transmission pipeline, 4.5 Tcf of natural gas storage capacity, and 12 Bcfd of LNG import capacity (INGAA 2009).

The U.S. gas pipeline network (see Figure 3.6) consists of more than 11,000 delivery points, 5,000 receipt points, 1,400 interconnection points, and 1,400 compressor stations that transfer natural gas throughout the country. In addition to the national network there are 49 export and import points, 13 LNG import facilities, and 100 LNG peaking facilities,[15] including approximately 400 geologic repositories for storage of natural gas. There are 11 primary transportation routes within the United States. They include five transmission lines originating in the producing areas of the southwest United States, two pipelines extending from the Rocky Mountain region, and four routes originating Canada. The pipeline network serving the contiguous 48 states is divided into six regions (see Figure 3.7).

EIA estimates that there are 1,532.82 Tcf of technically recoverable natural gas resources in the United States (EIA 2009b). In 2007, 19.28 Tcf of dry natural gas (about 90% of

[14] Gathering pipelines deliver natural gas from the recovery well to a gas-processing plant usually located close to the gas-producing well field where water and other contaminants are removed and the gas is made ready for interstate transport.

[15] LNG peak-shaving plants: These plants liquefy natural gas when demand is low and store the LNG until demand is high. Storage is facilitated by the volume reduction accomplished through converting the natural gas to a liquid state. During periods of high demand, the LNG is vaporized and injected into either the natural gas pipeline transmission system or a local distribution company system.

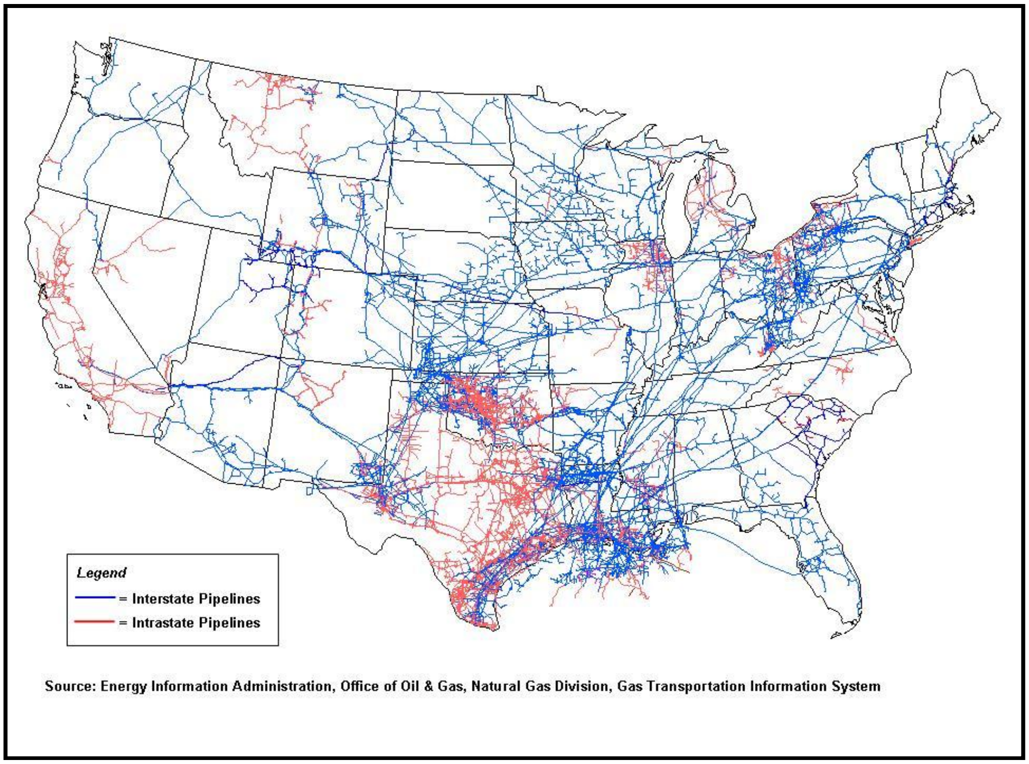

FIGURE 3.6 U.S. Natural Gas Pipeline Network, 2009 (Source: EIA 2009b)

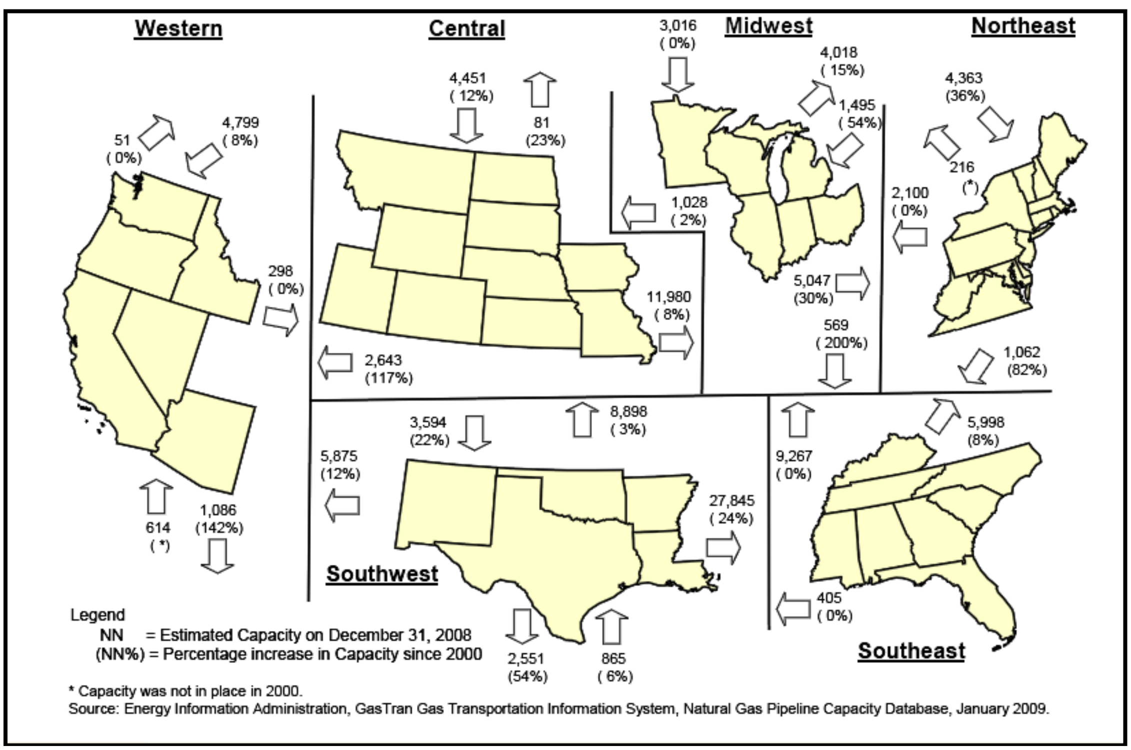

FIGURE 3.7 Natural Gas Pipeline Supply Regions and Capacity, 2009 (Source: EIA 2009b)

U.S. consumption) was produced in the United States (EIA 2009c). Five states, Louisiana, New Mexico, Oklahoma, Texas, and Wyoming, currently account for 79% of domestic production, with the majority recovered from conventional reservoirs (i.e., coexisting with or above crude oil deposits). However, the lower 48 states also contain substantial amounts of gas in unconventional reservoirs such as shale formations, coal-bed formations, and tight gas formations, the development of which will require pipeline expansions.[16,17] The Marcellus Shale Gas Play, part of the Devonian Black Shale Succession (see Figure 3.8) is estimated to contain 489 Tcf of recoverable gas. As many as 24 pipeline expansions projects have been announced by companies[18] with existing pipeline infrastructures in the vicinity of the formation to bring gas from this formation to market (Weber 2010). EIA projects that production of gas from shale formations will increase by 35% to 3.5 Tcf per year over the period 2007 to 2030 (EIA 2009c). In addition, the Department of the Interior's Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) (formerly Minerals Management Services [MMS]), estimates that the Gulf of Mexico contains approximately 420 Tcf of recoverable gas in undiscovered fields (BOEMRE 2010a), and projects that the Gulf of Mexico natural gas production of 2.2 Tcf in 2009 (BOEMRE 2010b) will reach 9.50 Bcfd (as much as 3.45 Tcf per year) by 2016 (BOEMRE 2007).

3.2.2 Projected Infrastructure Growth to Meet Demand

Uncertainties associated with long-term energy resource planning are functions of numerous factors, including long-term natural gas prices and variability, demand and supply issues, the discovery of new significant deposits of natural gas, technological advancements, policies and regulations that either facilitate or impede infrastructure expansions or resource development, public opinion both supporting and opposing new energy projects or infrastructures, public sentiment regarding climate change and reducing the nation's carbon footprint, and public acceptance of energy conservation programs that reduce overall energy demand or act to shave peaks in demand.

Both INGAA and EIA project growth in natural gas demand. INGAA estimates annual natural gas consumption will grow from about 26.8 Tcf in 2008 to 31.8 Tcf by 2030, a total market growth of 18% (INGAA 2009). EIA estimates that increased use of natural gas for electricity production will represent the majority of future natural gas demand in the industrial sector, which currently accounts for more than 37% of total demand (EIA 2010). Major factors affecting residential and commercial gas demand include restructuring of both the electric power and natural gas industries, regulations requiring greater energy efficiency, shifts in demographics and population centers, and technological advancements (e.g., the emergence of compressed natural gas–fueled vehicles) (WPA 2000). Both infrastructure and operational changes to the natural gas industry will be necessary to meet projected demands. INGAA estimates that approximately 80% of expenditures from 2009 to 2030 will go toward infrastructure expansions and upgrading, while increasing natural gas processing capacity will

[16] A tight gas reservoir is defined as gas contained in a geologic formation with relatively low permeability, such that some extent of fracturing of the rock by artificial means (typically hydraulic fracturing) is required before an extraction well can recover gas at economically viable rates and volumes.

[17] A more detailed discussion of unconventional gas formations can be found in a report published by the National Petroleum Council, titled *Topic #29, Unconventional Gas* (NPC 2007).

[18] Companies proposing pipeline expansions to serve the Marcellus Shale Gas Play include NiSource/Columbia Gas Transmission, Spectra/Texas Eastern Transmission, Tennessee Gas Pipeline, Dominion Transmission, and Transcontinental Gas Pipeline.

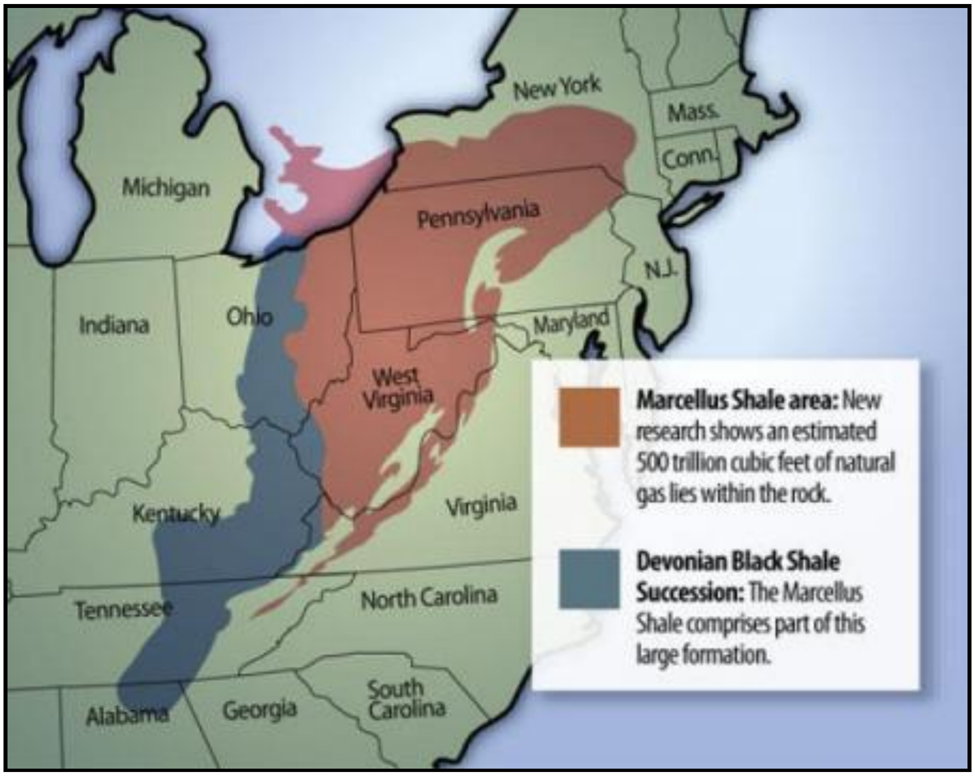

FIGURE 3.8 Marcellus Shale and the Devonian Black Shale Areas (Source: Weber 2010)

account for up to an additional 10% and development of LNG infrastructures, and expansions of geologic storage capacity will account for no more than 2 to 3% of expenditures.

INGAA estimates that meeting demand will require approximately 28,900 to 61,600 mi (46,510 to 99,136 km) of additional natural gas pipeline in the United States and Canada by 2030. In addition to intraregional expansions to access new production areas and demand centers, interregional transfer capacity (see Figure 3.7) will need to increase by 21 to 37 Bcfd from its current capacity of 130 Bcfd. Expansions of gas storage capacities and operational changes will also be necessary to maintain system stability and responsiveness to changing temporal patterns of gas consumption. The expected increase in natural gas usage for electricity production will change the current cyclical seasonal patterns of gas consumption by increasing summer consumption as the electricity thus produced is used to support residential and commercial cooling.

Tubb (2009) provides the following summary of the results of INGAA's natural gas supply and demand forecasts through 2030:

- All regions, including those with mature producing basins, will need natural gas infrastructure modifications to serve growing demand and/or shifts in demand.

- The Southwest and Central regions, with their unconventional natural gas resources, will experience the greatest expansions, accounting for as much as 45% of the total projected expansions in supply infrastructure while accounting for only 23% of the projected growth in national consumption.

- The Western and Northeast regions will continue as consuming regions, accounting for only 13 to 15% of projected incremental pipeline construction through 2030.

3.2.3 Existing Delivery Patterns and Projected Expansions

Gas resources in the Gulf of Mexico, the midcontinent, western Canada, and the Rockies are the primary internal resources supplying the interstate pipeline network. Substantial amounts of gas flow out of these resource areas to load centers in the Midwest, East and West Coasts, and Florida (see Figure 3.9). LNG imports represent a significant and growing portion of the U.S. supply. As of November 8, 2010, FERC reported there are 13 LNG terminals in the United States with a combined capacity of more than 15 Bcfd; an additional 18 terminals are approved, with 3 currently under construction, and 5 additional terminals have been proposed (FERC 2010).

INGAA projects that by 2030 new interregional flow patterns will emerge (see Figure 3.10) to connect gas from unconventional fields in the Mid-Continent and Northern Rockies with the existing interstate system. Expansions of the pipeline network to accommodate increases in interregional flows will occur in the "Rockies Express" corridor from Wyoming to the Northeast, the Mid-continent and East Texas to Northern Louisiana corridor, the Western Canada to Chicago corridor, and along the Gulf Coast into Florida. Ports in Florida are expected to enjoy the greatest volumetric increase of imported LNG and require a greater expansion of the pipeline network than other LNG ports to connect imported gas to the existing interstate system. New segments will also be built to support gas recovered from plays in the Arctic regions of Alaska and Canada. Proposed expansions will

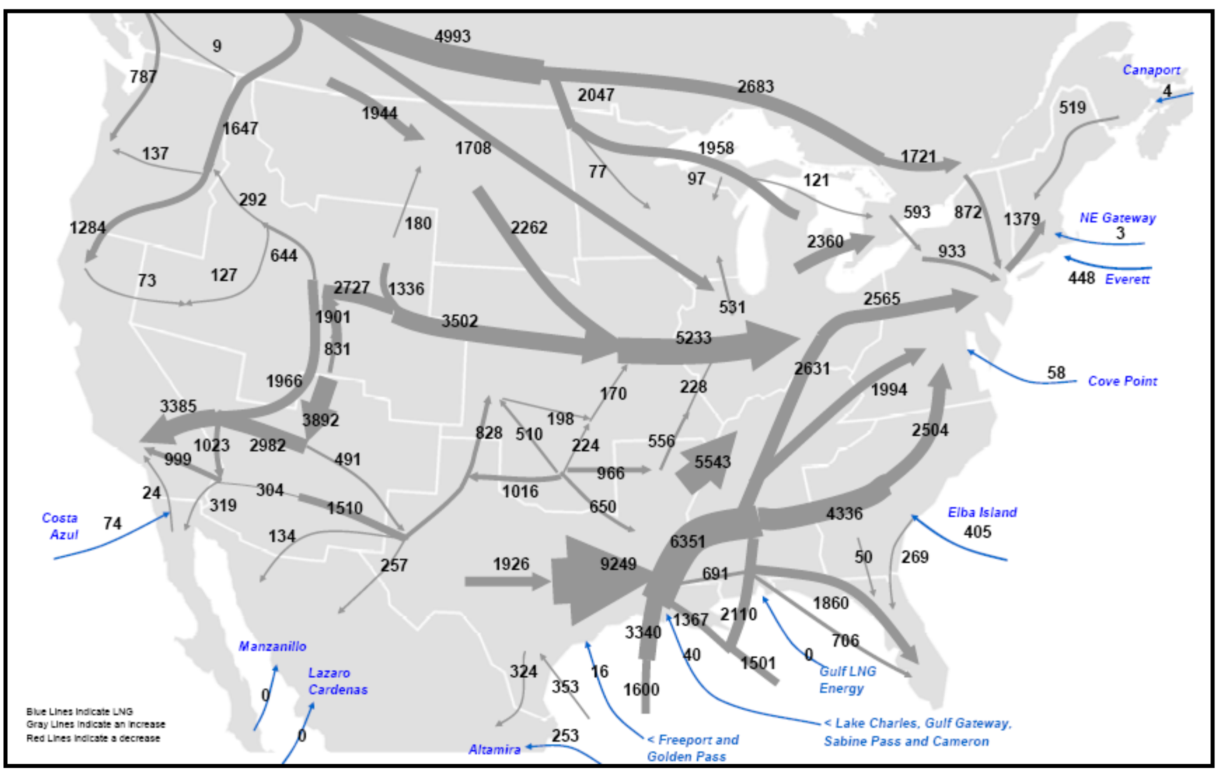

FIGURE 3.9 Interregional Flows (million cubic feet per day) in 2008 (Source: INGAA 2009)

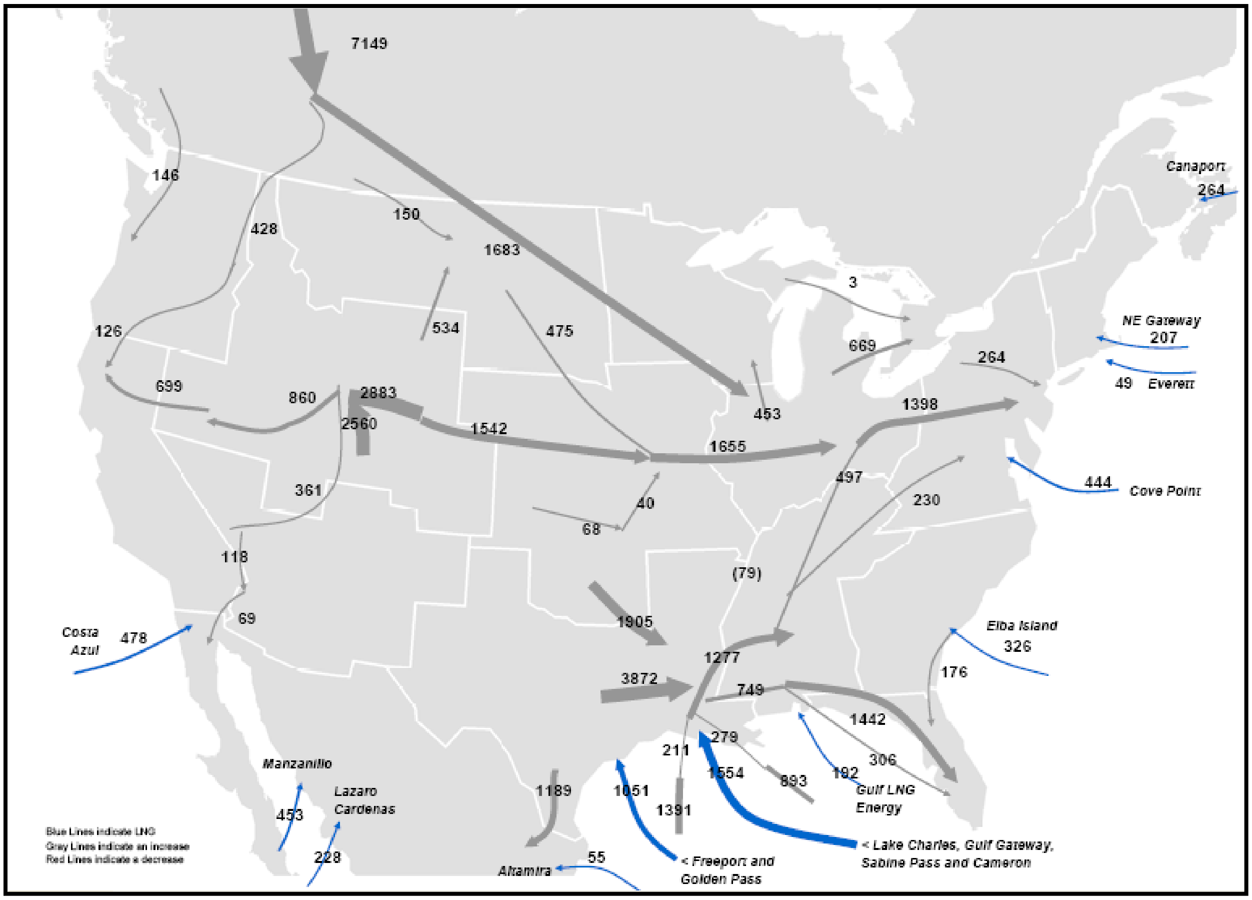

FIGURE 3.10 Projected Increases in Interregional Flow (million cubic feet per day), Base Case, 2008–2030 (Source: INGAA 2009)

result in an additional 3,000 mi (4,828 km) of pipeline per year.

While the majority of this new construction will be to support the long-distance interregional transfers of new supplies, the pipeline network serving mature gas basins and established demand centers will also require some amendments to accommodate shifts in demand or the growth or decline of demand centers. The introduction of substantial amounts of unconventional supplies (especially shale gas) will be the primary drivers for pipeline network changes, with the southwest and central regions of the country enjoying as much as 45% of the anticipated changes while only representing 23% of the projected growth in consumption. The west and northeast will continue to be areas of high consumption but will see only 13 to 15% of network amendments.

3.3 PETROLEUM PIPELINES

3.3.1 Current State of the Industry

Pipelines are the primary transportation mode for moving crude oils from source areas to refineries and petroleum distillate fuels and petrochemical feedstocks to their points of consumption. The crude oil pipeline infrastructure is separate from the infrastructure that delivers petroleum fuels and products. The United States is divided into five Petroleum Administration for Defense Districts (PADDs).

Created during World War II to help organize the allocation of petroleum fuels, PADDs are still utilized for data collection and system description purposes. Figure 3.11 shows the five districts. Table 3.2 shows the monthly movements by pipeline between PADDs.

3.3.2 Crude Gathering and Trunk Lines, and Product Distribution Pipelines

Crude oil pipelines are categorized as either gathering lines or trunk lines. Gathering lines are typically small-diameter (2 to 6 in. [5 to 15 cm]) pipelines that collect crude oil from producing areas and transport it to a hub location for preliminary processing and subsequent transport to refineries via larger-diameter (8 to 24 in. [20 to 61 cm] trunk lines. There are approximately 55,000 mi (88,514 km) of crude oil trunk lines and 30,000 to 40,000 mi (48,280 to 64,374 km) of gathering lines in the United States (Pipeline101.com 2007a). Crude oil pipelines can be located either onshore or offshore, or a combination of the two. Gathering lines are primarily located in Texas, Oklahoma, Louisiana, and Wyoming. A significant network of gathering lines exists in the Gulf of Mexico to deliver crude oil from offshore drilling rigs to refineries in Louisiana and Texas. Less extensive gathering system networks are located in other oil-producing states.

Product pipelines transport refined petroleum products such as petrochemical feedstocks and consumer products such as gasoline, aviation turbine fuel, diesel fuel, and home heating oil. They typically originate at or near refineries and terminate at distribution terminals located in retail market areas. In the contiguous United States, there are approximately 95,000 mi (152,889 km) of product pipelines that vary in diameter from 6 to 42 in. (15 to 107 cm) (Pipeline101.com 2007b). The Trans-Alaska Pipeline System (TAPS) is a 48-in. (122-cm) diameter crude oil pipeline that delivers crude oil from the North Slope to Prudhoe Bay, Alaska. Virtually all crude oil and product pipelines are buried. However, aside from having the largest diameter pipe, TAPS is unique in that approximately half of its 800-mi (1,287-km) length is above ground to avoid burial in the permafrost that exists along its route.

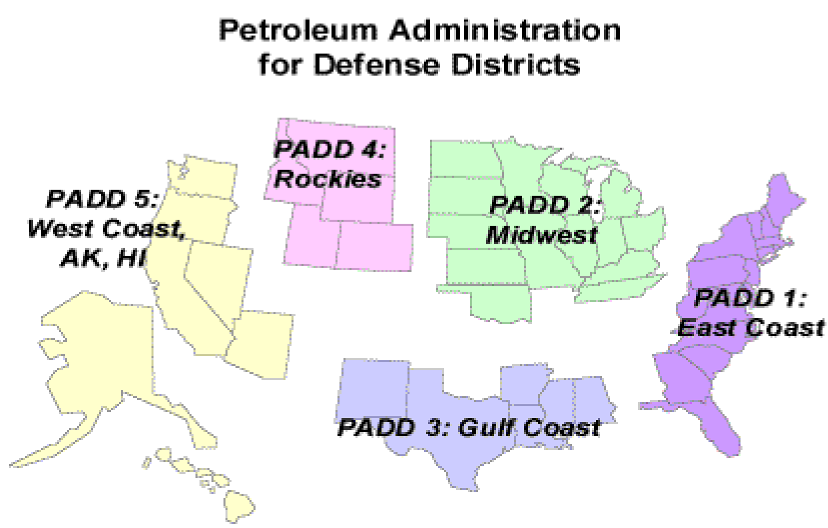

FIGURE 3.11 U.S. Petroleum Administration for Defense Districts Map (Source: EIA undated)

TABLE 3.2 Monthly Movements of Petroleum by Pipeline between PADDs[a]

Direction of Movement	Crude	Products
From PADD 1 to		
PADD 2	0	9,595
PADD 3	354	0
From PADD 2 to		
PADD 1	198	1,789
PADD 3	1,668	8,428
PADD 4	1,575	1,450
From PADD 3 to		
PADD 1	465	71,795
PADD 2	33,223	22,723
PADD 4	0	1,002
PADD 5	0	4,553
From PADD 4 to		
PADD 2	5,257	3,869
PADD 3	159	6,032
PADD 5	0	993
From PADD 5 to		
PADD 3	0	0
PADD 4	0	0

[a] Six-month average ending in January 2010; data in thousands of barrels.

Source: EIA (2010).

3.3.3 Crude Oil and Refined Petroleum Products Volume Forecasts

According to EIA projections (EIA 2010), beginning in 2008 and continuing through 2035, oil production in the Lower 48 is expected to increase from 4.28 million barrels per day in 2008 to 5.83 million barrels per day in 2035, an annual rate of increase of 1.2%. However, the existing crude oil pipeline infrastructure is expected to absorb this increase with only incremental expansions, representing an annual growth rate of only 0.1%. Growth in crude oil imports is expected to be moderated by increased use of biofuel (much of which will be produced domestically), demand reductions due to regulated efficiency standards, and higher energy prices that spur domestic crude oil production from conventional as well as nonconventional sources. The total liquid fuels consumption, excluding LPGs that are transported in dedicated pipelines, is projected to increase from 17.58 million barrels per day in 2008 to 19.87 million barrels per day in 2035, resulting in a total increase of 13% and a modest rate of increase of 0.5% per year. Over the same period, changes in population distribution could require capacity increases or pipeline expansion in areas of significant population increase, and idling of pipelines in areas of significant population decrease.

3.3.3.1 New Capacity Additions to the Transportation System to Support Gulf of Mexico Production

The U.S. Department of the Interior's BOEMRE projected that despite declines in Gulf of Mexico crude oil production over the years 2004 through 2007, production would increase from 1.22 million barrels per day in 2009 to 1.74 million barrels per day in 2018 (MMS 2009). Gulf of Mexico crude oil production is expected to continue to represent approximately 25% of daily domestic supply.

3.3.3.2 Additional Pipelines to Accommodate Growth in Crude Imports Arriving at Gulf Coast Ports

Total crude oil imports from countries other than Canada are forecast to decline by 11% in the period 2008 to 2035; crude oil imports from Canada are projected to increase from 2.75 million barrels a day in 2008 to 4.5 million barrels a day in 2035, supported by the construction of new pipelines as discussed below (EIA 2010).

3.3.3.3 Addition of Crude Trunk Line Capacity to Accommodate Canadian Imports

Canada is the largest source of foreign crude oil imported into the United States. Approximately 1,956,000 barrels per day of crude oil are shipped into the United States from Canada, representing approximately 19% of all imports in 2008. Canadian crude production has risen steadily in recent years, primarily due to development of the Alberta oil sands in western Canada. Oil sand production has been predicted to grow from 1.2 million barrels per day in 2008 to more than 3.3 million barrels per day by 2025 (CAPP 2009). The majority of crude oil pipeline expansions expected in the near future will be made to support this increase.

Currently, three major crude oil trunk lines deliver crude oil from western Canada to the United States: the Enbridge Pipeline, the Trans-Mountain Pipeline, and the Express Pipeline; the latter two are owned by Kinder Morgan. In 2008, these three major trunk lines transported more than 1.8 million barrels per day of crude oil. In March 2010, the National Energy Board of Canada approved a project by TransCanada known as the Keystone XL pipeline (TransCanada 2011). The proposed project is a 36-in. (91-cm) crude oil pipeline that would begin in Hardisty, Alberta, and extend southeast through Saskatchewan, Montana, South Dakota, and Nebraska. It would incorporate a portion of the newly built Keystone Pipeline through Kansas to Cushing, Oklahoma, then continue through Oklahoma to a delivery point near existing terminals in Nederland, Texas, to serve the Port Arthur, Texas, refineries, all of which are capable of processing the heavy Canadian crude[19] (see Figure 3.12).[20] Also proposed is a 50-mi (80-km) pipeline to the Houston market with an eventual capacity of 900,000 barrels per day. Completion of the abovementioned pipeline projects, together with continued operation of existing trunk lines, would satisfy transfer capacity requirements for Canadian crude resources into U.S. markets through 2025.

3.3.3.4 Pipeline Infrastructure Changes in the Gulf Coast Area

In 2008, Oil Tanking announced a project to build what is known as the Texas Offshore Port System. The project would offload ships 36 mi (58 km) off the coast from Freeport, Texas, and deliver oil through 160 mi (257 km) of pipeline to Gulf Coast refineries.

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19 The Exxon-Mobil Pegasus pipeline, with a capacity of 96,000 barrels per day, is also currently delivering heavy Canadian crude to refineries in Port Arthur, Texas.

20 See TransCanada (2011) for additional details on the Keystone XL project.

FIGURE 3.12 Keystone XL Pipeline Project Route

3.3.3.5 Addition of Trunk Line Capacity from the Gulf Coast to the Northeast and Midwest Refining Markets

Currently, there are no known plans for projects to add trunk line capacity for petroleum products from the Gulf Coast to the Midwest or Northeast. Projections are that U.S. oil demand will remain near its present level through 2035. Any growth in demand for liquids is expected to be taken up by renewable fuels such as ethanol and biodiesel.

Recently, there was a reduction of Northeast refining capacity. In late 2009, Sunoco closed its 145,000 barrel per day Eagle Point refinery in New Jersey, and Valero closed its 182,000 barrel per day refinery in Delaware. There has been a corresponding increase in Gulf Coast refining capacity as Marathon started operation at its 180,000 barrel per day refinery expansion in Garyville, Louisiana, in early 2010. This could indicate a need for more capacity from the Gulf Coast to the Northeast. However, the impact of refinery closures on the East Coast was diminished by a growing availability of total gasoline imports, which typically supply about 25% of the consumption for that region (IBT Commodities 2010). Refineries on the Gulf Coast also have the option of shipping products via tanker to the New York harbor area as well as to other East Coast destinations.

While refineries are closing on the East Coast, BP is spending $3.8 billion in the Midwest to reconfigure its Whiting, Indiana, refinery near Chicago to process Canadian heavy crude and increase capacity by 260,000 barrels per day (Downstreamtoday.com 2009); this lessens the need for crude feedstocks and products from the Gulf Coast to serve the Midwest refineries and retail markets.

3.3.3.6 Additions to Crude Gathering and Trunk Lines in the Rocky Mountains to Serve the Midwest Refineries

Recent technological advances in oil extraction have markedly increased availability of crude oil from the Bakken shale oil field, which extends across parts of Montana and North Dakota and the Canadian provinces of Saskatchewan and Manitoba, and have made North Dakota the fourth-largest producing state after Texas, Alaska, and California. Horizontal drilling techniques have helped double production in North Dakota in the last 3 years to 80 million barrels per day, surpassing the capacity of existing pipelines and resulting in oil producers resorting to transporting crude oil by a newly built rail line to refineries in the Midwest (Casselman 2010). The Enbridge North Dakota System (see Figure 3.13) underwent a 51,600 barrel per day expansion in January 2010 to add 330 mi (531 km) of gathering lines and 620 mi (998 km) of interstate pipeline to deliver crude from Montana and North Dakota wells in the Williston Basin to the Enbridge metering

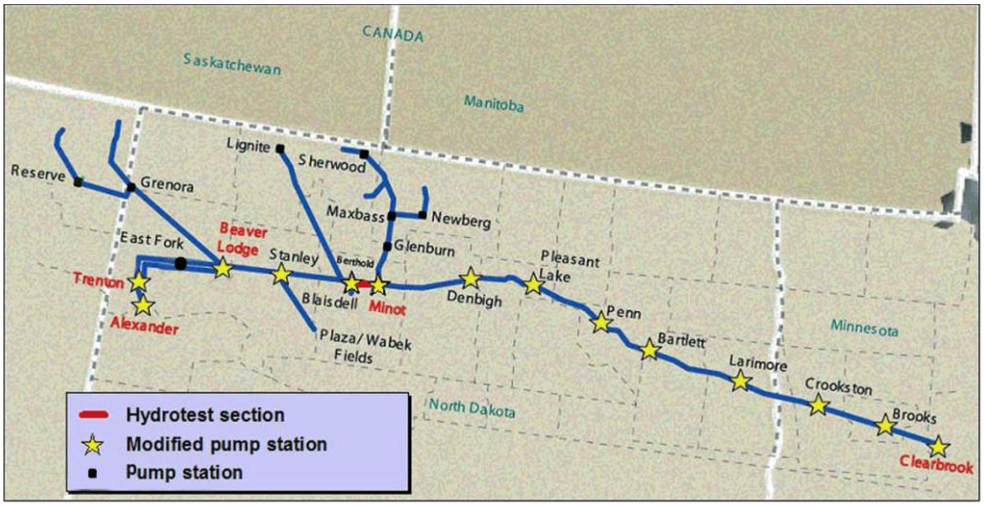

FIGURE 3.13 Enbridge's North Dakota System Expansion Phase 6 (Source: Enbridge 2010)

station at Clearbrook, Minnesota, where it is transferred through previously existing pipelines to refineries in the Minneapolis–St. Paul area (Enbridge 2010).

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4 CURRENT ENERGY TRANSPORTATION INFRASTRUCTURE ON FEDERAL LANDS IN THE SECTION 368(B) STATES

4.1 INTRODUCTION

To fully evaluate the potential for federal lands to support future energy transport in the 368(b) states, it is important to understand not only the contribution that federal lands make to the total land of the 368(b) states, but also the current level of energy transport that occurs on federal and non-federal lands in these states. The following sections discuss the ownership and amounts of federal lands currently present in the 368(b) states, as well as the type and amount of existing energy transport infrastructure present on federal and non-federal lands in each of those states. Together, this information will help in understanding the potential for federal lands to provide for future energy transport.

4.1.1 Energy Transport Infrastructure on the 368(b) States

The 368(b) states currently support thousands of miles of high-voltage (≥230 kV) electricity transmission lines, natural gas pipelines, and large (≥8 in. [≥20 cm] oil pipelines [Table 4.1]). Virtually all high-voltage electricity transmission (99%), natural gas pipeline (99%), and large oil pipeline (97%) infrastructure occurs in the lower 368(b) states, with little or no similar-sized energy transport infrastructure in Hawaii (Table 4.2). The amount of energy transmission infrastructure that actually crosses federally managed lands, however, is quite small; it represents less than 2% of the electricity transmission lines and natural gas pipelines, and less than 3% of the oil pipelines present in the Section 368(b) states. Currently, only about 1,100 mi (1,770 km) of high-voltage electricity transmission lines cross federal lands in the Section 368(b) states, in sharp contrast to the 61,436 mi (98,871 km) of high-voltage transmission lines present on non-federal lands in the same states. The majority (almost 90%) of this infrastructure crosses federal lands managed by four agencies: the NPS, USFS, DOD, and USFWS (Table 4.1). In contrast, less than 1 mi (2 km) of high-voltage electricity transmission crosses BLM lands, and less than 45 mi (72 km) are on lands managed by the TVA or USBR.

The distribution of natural gas and large oil pipelines follows a pattern similar to that of electricity transmission; comparatively little of either pipeline type actually crosses federal lands in the 368(b) states. While there are about 260,000 mi (418,429 km) of natural gas pipeline in the Section 368(b) states, only about 4,300 mi (6,920 km) of this pipeline crosses federal lands (Table 4.1). As with electricity transmission infrastructure, BLM lands are the least crossed by natural gas pipelines (15 mi [24 km]), while half of federal land crossings (about 1,755 mi [2,824 km]) occur on USFS lands. Only about 834 mi (1,342 km) of large oil pipelines cross federal lands in Section 368(b) states. The majority of these crossings occur on BLM, USFS, and NPS lands, and there is little or no crossing of lands managed by the USBR or TVA (Table 4.2).

4.2 REGIONAL LAND OWNERSHIP AND ENERGY TRANSPORT INFRASTRUCTURE DISTRIBUTION

Because of the number of states and their geographic settings, the discussion of land ownership and energy transport infrastructure distribution within the 368(b) states is presented on a regional basis:

- Upper Great Plains Region—North Dakota, South Dakota, and Nebraska;
- Lower Great Plains Region—Kansas, Oklahoma, and Texas;
- Central Region—Iowa, Missouri, and Arkansas;

TABLE 4.1 Total Linear Miles of Energy Transport Infrastructure in the 368(b) States

	Infrastructure Type[b]		
	≥230-kV Electricity Transmission Line (mi)	Natural Gas Pipeline (mi)	≥8-in.-diameter Oil Pipeline (mi)
All lands	62,212	256,205	29,287
Federal land[a]	1,053	4,313	823
USFS	469	1,755	228
NPS	252	501	146
BLM	<1	336	290
USFWS	102	631	75
DOD	145	984	80
TVA	46	45	1
USBR	6	31	3
DOE	33	24	0
AG RES	0	7	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

- Great Lakes Region—Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York;
- Gulf Coast Region—Louisiana, Mississippi, Alabama, and Florida;
- Appalachian Region—Tennessee, Kentucky, and West Virginia;
- Southern Atlantic Region—Georgia, North and South Carolina;
- Mid-Atlantic Region—Virginia, Maryland, Delaware, New Jersey, and the District of Columbia;
- New England Region—Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine; and
- Alaska and Hawaii.

Total land area of the lower 368(b) states varies widely among the regions (Table 4.3). The Mid-Atlantic and New England regions have the smallest areas (each <60,000 mi^2 [155,399 km^2]) of the nine regions, each representing 4% or less of the total land area of the lower 368(b) states. In contrast, the land areas of the Lower Great Plains and Great Lakes regions have the largest land areas (each about 375,000 mi^2 [971,246 km^2]), each accounting

TABLE 4.2 Total Linear Miles of Energy Transport Infrastructure in the 368(b) States and Alaska and Hawaii

	Infrastructure Type[b]								
	≥230-kV Electricity Transmission Lines by State (mi)			Natural Gas Pipelines by State (mi)			>8-in.-diameter Oil Pipelines by State (mi)		
	Lower 368(b) States	Alaska	Hawaii	Lower 368(b) States	Alaska	Hawaii	Lower 368(b) States	Alaska	Hawaii
Infrastructure present on all lands	61,437	775	0	254,523	1,660	22	28,299	988	0
Infrastructure on federal lands	784	269	0	3,872	439	2	522	301	0
Federal land[a]									
USFS	217	252	0	1,744	11	0	228	0	0
NPS	252	0	0	501	0	0	146	0	0
BLM	<1	<1	0	15	321	0	0	290	0
USFWS	98	4	0	572	59	0	75	0	0
DOD	132	13	0	933	49	2	69	11	0
TVA	46	0	0	45	0	0	1	0	0
USBR	6	0	0	31	0	0	3	0	0
DOE	33	0	0	24	0	0	<1	0	0
AG RES	0	0	0	7	0	0	0	0	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

for about 23% of the total land area of the lower 368(b) states (Table 4.3).

Federal lands account for only about 7% of the total land area of the lower Section 368(b) states (Table 4.3). The Upper Great Plains Region has the most federal land, about 12%. The Lower Great Plains and Great Lakes Regions have the highest percentage of federal land; about 23% of each region is federal land. Federal lands account for no more than 11% of the total land area of the other regions.

The Lower Great Plains, Great Lakes, and Gulf Coast Regions have the most energy transport infrastructure in the lower Section 368(b) states. Together, these three regions contain about 74% of the total infrastructure, with the Upper Great Plains Region accounting for about 33% (about 110,000 mi [177,028 km]) of the total infrastructure in the lower Section 368(b) states (Table 4.4). The other regions account for no more than 7% of the total infrastructure in the regions. The amount of infrastructure in these regions that actually crosses federal lands is relatively small. With the exception of the Appalachian Region, no more than 4% of the existing infrastructure within any region crosses federal lands; miles of infrastructure on federal lands in these regions ranges from as few as 45 mi (72 km) in New England to about 1,700 mi (2,736 km) in the Great Lakes Region (Table 4.4). In contrast, about 16% (3,343 mi [5,380 km]) of the energy transport infrastructure in the Appalachian Region occurs on federal lands.

4.2.1 Upper Great Plains Region

4.2.1.1 Land Ownership

The Upper Great Plains Region (North Dakota, South Dakota, and Nebraska) covers about 200,000 mi^2 (517,998 km^2), of which only about 5% is federal land (Table 4.5); these federal lands are generally scattered throughout

TABLE 4.3 Land Areas of the Lower Section 368(b) States, by Region

Region	Total Land Area (mi^2)[a]		Federal Land Area (mi^2)[a]	% Contribution of Federal Lands[c]
Upper Great Plains	199,74	(12%)[b]	28,749	14
Lower Great Plains	375,190	(23%)	11,029	3
Central	158,795	(10%)	8,889	6
Great Lakes	377,104	(23%)	23,962	6
Gulf Coast	182,366	(11%)	13,116	7
Appalachian	94,694	(6%)	6,740	7
Southern Atlantic	124,419	(8%)	9,167	7
Mid-Atlantic	52,502	(3%)	4,412	8
New England	57,942	(4%)	2,459	4
Total	1,622,755		108,523	7

[a] To convert mi^2 to km^2, multiply by 2.590.

[b] Values in parentheses are the percent contribution of the region land area to the total land area of the lower Section 368(b) states.

[c] Percentage of the region's total land area that is under federal ownership and management.

TABLE 4.4 Miles of Energy Transport Infrastructure in the Lower Section 368(b) States, by Region

Region	Miles of Infrastructure on All Lands[a]		Miles of Infrastructure on Federal Lands[a]	% Contribution of Infrastructure on Federal Lands to the Total Infrastructure of the Region[c]
Upper Great Plains	13,229	(4%)[b]	221	2
Lower Great Plains	109,821	(33%)	995	1
Central	24,339	(7%)	313	1
Great Lakes	85,035	(26%)	1,708	2
Gulf Coast	48,222	(15%)	2,113	4
Appalachian	20,736	(6%)	3,343	16
Southern Atlantic	14,130	(4%)	156	1
Mid-Atlantic	7,865	(2%)	221	3
New England	4,637	(1%)	45	1
Total	328,014		9,115	3

[a] To convert mi to km, multiply by 1.609.

[b] Values in parentheses are the percent contribution of the region's energy transport infrastructure to the total infrastructure present in the lower Section 368(b) states.

[c] Percentage of the total infrastructure that occurs on federal land.

TABLE 4.5 Federal Land Ownership in the Upper Great Plains Region

State	All Lands (mi^2)[a]	Federal Lands (mi^2)[a]	% Contribution of Federal Land
North Dakota	63,190	3,455	5
South Dakota	68,289	4,713	7
Nebraska	68,264	1,125	2
Total	199,743	9,293	5

[a] To convert mi^2 to km^2, multiply by 2.590.

each of the three states. South Dakota has the most federal land in this region (about 4,700 mi^2 [12,173 km^2]), but it composes only about 7% of that state's total land area (Table 4.5). Federal lands account for only about 5% (3,455 mi^2 [8,948 km^2]) of the land area of North Dakota, and only about 2% (about 1,125 mi^2 [2,914 km^2]) of Nebraska is federal land.

Federal lands in the Dakotas, which occur generally in the western portions of these states, include two national grasslands, five national parks, three military installations, and more than 40 NWRs (Figure 4.1). In Nebraska, federal lands are generally located in the northwestern portion of the state; they include a national grassland, four NWRs, a national scenic river corridor, five military installations, and a

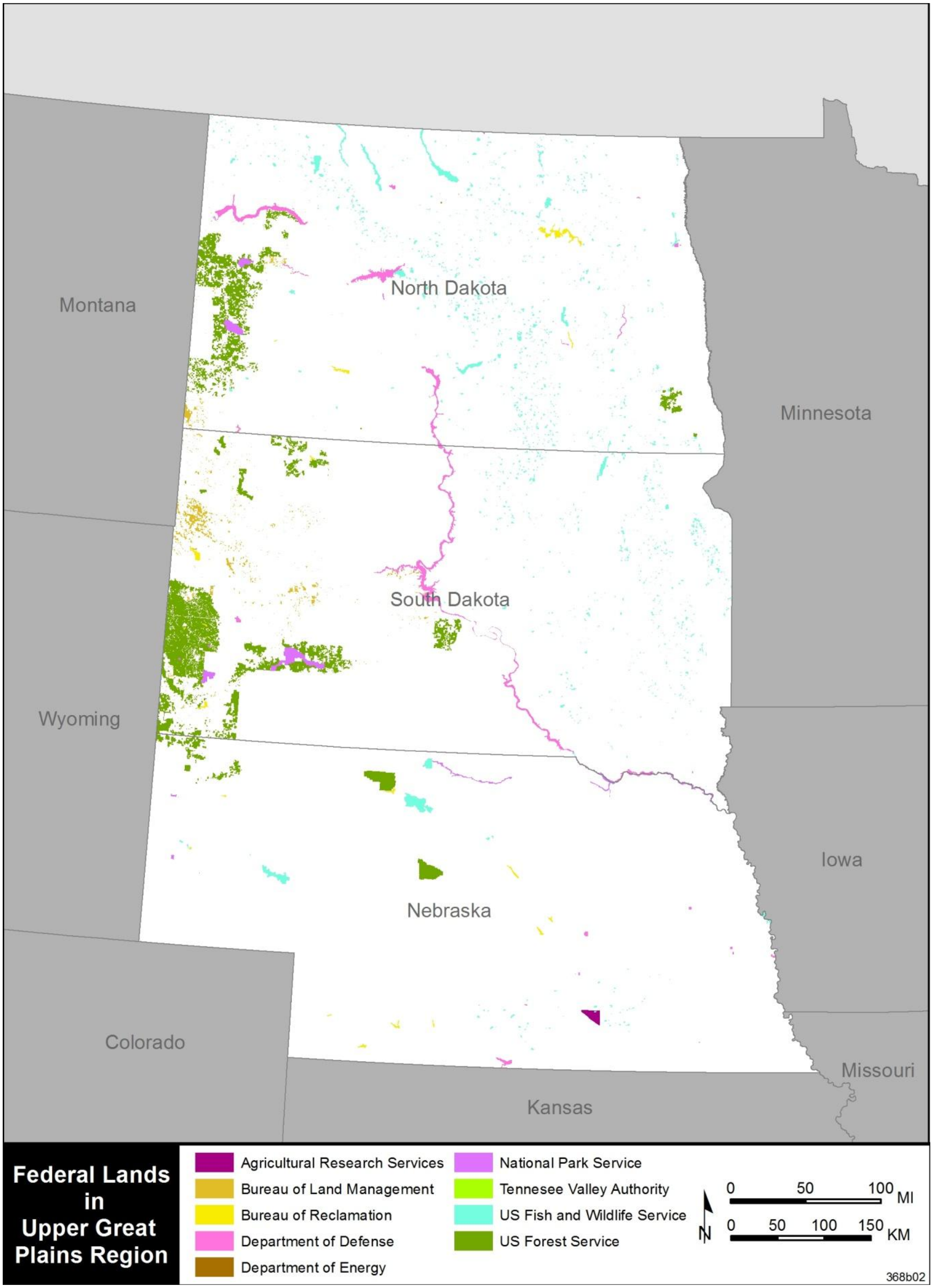

FIGURE 4.1 Federal Lands in the States of the Upper Great Plains Region

U.S. Department of Agriculture (USDA) research station.

4.2.1.2 Energy Transport Infrastructure

The Upper Great Plains Region has about 13,000 linear miles (20,921 km) of energy transport projects, of which less than 2% (211 mi [340 km]) cross federal lands in any of the three states (Table 4.6). Only about 100 mi (161 km) of federal land are crossed in either North or South Dakota, while only about 21 mi (34 km) of federal land are crossed in Nebraska. While electricity transmission lines and natural gas pipelines cross federal lands in each of the three states of the region, oil pipelines cross federal lands only in North Dakota (Table 4.6).

High-Voltage Electricity Transmission. There are approximately 3,675 linear miles (5,914 km) of high-voltage (≥230 kV) electricity transmission lines in the Upper Great Plains Region (Table 4.6). Of this infrastructure, only about 115 mi (185 km) (about 3%) actually cross federal lands. Federal lands with the most high-energy electricity transmission line crossings are those managed by the NPS (Buffalo Gap National Grassland and the Black Hills National Forest) in South Dakota and by the DOD (Grand Forks Air Force Base) in North Dakota (Table 4.7). There is very little high-voltage electricity transmission infrastructure crossing federal land in Nebraska (only about 3 mi [5 km]); these crossings occur on the Oglala National Grassland and the Agate Fossil Beds National Monument in the northwestern portion of the state.

Natural Gas Pipelines. The Upper Great Plains Region has almost three times as many miles of natural gas pipelines (8,684 linear miles [13,976 km]) as high-voltage electricity transmission lines (Table 4.6); very little of this natural gas infrastructure (1%), however, actually crosses federal lands in the region. There are only about 52 mi (84 km) of natural gas pipeline crossing federal land in North Dakota, and the majority of these crossings occur on USFS (37 mi [60 km]) lands (Table 4.7). South Dakota and Nebraska have similar amounts of pipeline crossing federal lands (about 20 mi [32 km] each). In South Dakota, almost all of the crossings occur on BLM and USFWS lands, while in Nebraska most of the crossings occur on lands managed by the DOD (6 mi [10 km]) and a USDA Research Station (7 mi [11 km]).

TABLE 4.6 Total Linear Miles of Energy Transport Infrastructure in the Upper Great Plains Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		≥8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
North Dakota	1,408	30	1,976	52	649	15
South Dakota	804	82	1,575	21	0	0
Nebraska	1,463	3	5,133	18	0	0
Total	3,675	115	8,684	91	649	15

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.7 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Upper Great Plains Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]			Natural Gas Pipelines by State (mi)[c]			≥8-in.-diameter[d] Oil Pipelines by State (mi)[c]		
Agency[a]	ND[b]	SD[b]	NE[b]	ND	SD	NE	ND	SD	NE
USFS	5	0	0	37	0	3	10	0	0
NPS	0	56	<1	0	0	<1	0	0	0
BLM	0	0	0	2	11	0	0	0	0
USFWS	6	6	1	4	9	2	1	0	0
DOD	15	20	0	8	1	6	4	0	0
TVA	0	0	0	0	0	0	0	0	0
USBR	4	0	1	1	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	7	0	0	0
Total	30	82	3	52	21	18	15	0	0

[a] USFS = U.S. Forest Service; NPS = U.S. National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] ND = North Dakota; SD = South Dakota; NE = Nebraska.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

Oil Pipelines. There are fewer than 650 mi (1,046 km) of large oil pipelines in the Upper Great Plains Region, all of which occur in North Dakota (Table 4.6). Only about 15 mi (24 km) of this infrastructure cross federally managed land (Table 4.7), with most of the crossings (about 10 mi [16 km]) occurring on USFS lands. No federal lands are crossed by large oil pipelines in either South Dakota or Nebraska.

4.2.2 Lower Great Plains Region

4.2.2.1 Land Ownership

The Lower Great Plains Region has a combined land area of about 375,200 mi^2 (971,764 km^2), of which about 2% (8,554 mi^2 [22,155 km^2]) is federally managed land (Table 4.8). Of the three states in this region, Texas has the largest total land area, as well as the most federal land. While Oklahoma and Kansas are similar in size, Oklahoma has almost three times the amount of federal land that occurs in Kansas (about 2,210 and 850 mi^2 [5,724 and 2,201 km^2], respectively).

Federal lands in Kansas, which total about 850 mi^2 (2,201 km^2) and account for about 1% of the total area of the state, are widely distributed across the state. The largest parcels of federal lands are associated with military installation; other federal lands in the state include national grasslands, NWRs, and a national historic site. About 3% (2,210 mi^2 [5,724 km^2]) of Oklahoma is federal land (Table 4.8). These lands are widely distributed

TABLE 4.8 Land Ownership in the Lower Great Plains Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Kansas	72,752	851	1
Oklahoma	62,238	2,210	3
Texas	240,200	5,493	2
Total	375,190	8,554	2

[a] To convert mi^2 to km^2, multiply by 2.590.

across the state (Figure 4.2) and include seven NWRs, a national grassland, a national recreation area, and two large military installations. While Texas has the most federal land (5,500 mi^2 [14,245 km^2]) of the three states in the region, these federal lands account for less than 2% of the total land area of the state (Table 4.8). As with the other states in the region, federal lands are scattered throughout Texas, although many are located in the southeastern portion of the state (Figure 4.2). Federal lands in Texas include 2 national parks, 13 military installations, 12 NWRs, a national recreation area, and two national grasslands.

4.2.2.2 Energy Transport Infrastructure

The three states of the region are crossed by about 109,000 mi (175,419 km) of energy transport infrastructure; about 12,000 mi (19,312 km) of high-voltage electric transmission lines, 13,000 mi (20,921 km) of large oil pipelines, and 84,000 mi (135,185 km) of natural gas pipelines (Table 4.9). Most of this infrastructure (about 72%) occurs in Texas, while Kansas and Oklahoma have similar amounts of the rest (about 14% each).

High-Voltage Electricity Transmission. There is little high-energy electricity transmission infrastructure on federal land in the Lower Great Plains Region. This region has about 12,800 mi [20,600 km]) of high-voltage electricity transmission lines, of which only about 66 mi (106 km) cross federal lands (Table 4.9). Most crossings of federal land in the region by electric transmission lines occur in Texas (57 mi [92 km]; about 80%), mostly (about 45 mi [72 km]) on DOD-managed lands (Table 4.10). In fact, DOD manages the majority of the federal lands in all three states that are crossed by high-energy electricity transmission lines. Federal lands in Kansas have about 2 mi (3 km) of electricity transmission lines crossing them, while federal lands in Oklahoma have only about 11 mi (18 km) of electricity transmission line crossings.

Natural Gas Pipelines. There are about 810 mi (1,304 km) of natural gas pipelines that cross federal lands in the Lower Great Plains Region (Table 4.9). As with electricity transmission line crossings in the region, most of the natural gas pipeline crossings (79%) of federal land occur in Texas (Table 4.9). In Texas, most of the crossings occur on lands managed by the DOD (52%), USFWS (19%), and USFS (18%) (Table 4.10). DOD lands are also those most crossed by natural gas pipelines in Kansas (38% of all crossings) and Oklahoma (88% of all crossings).

Oil Pipelines. There are only about 120 mi (193 km) of oil pipeline that cross federal lands in the Lower Great Plains Region, and no federal lands are crossed by oil pipelines in Kansas (Table 4.9). As with natural gas pipeline crossings of federal lands in the region, most of

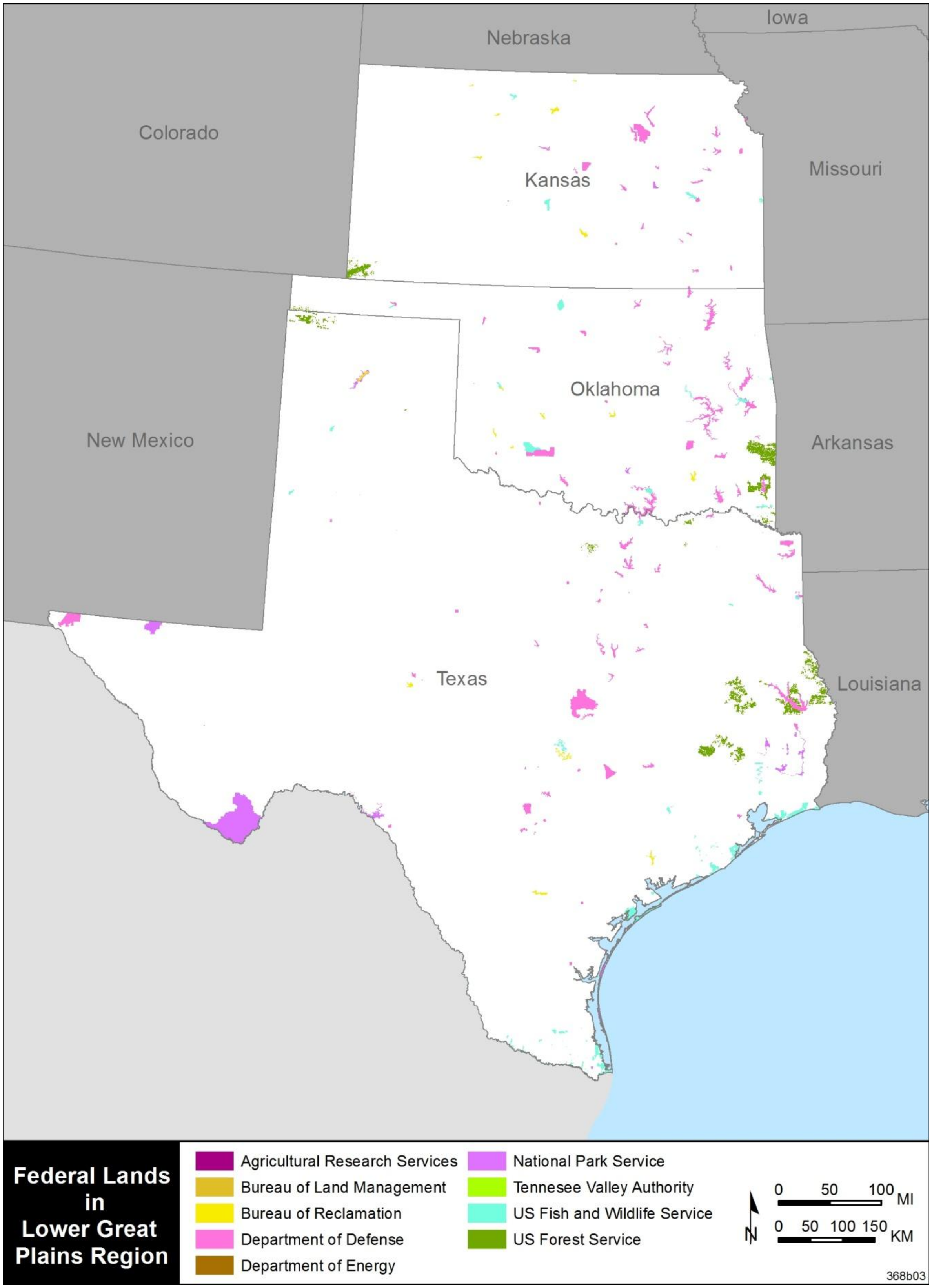

FIGURE 4.2 Federal Lands in the States of the Lower Great Plains Region

TABLE 4.9 Total Linear Miles of Energy Transport Infrastructure in the Lower Great Plains Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Kansas	1,671	2	13,753	105	124	0
Oklahoma	1,623	10	11,925	66	1,689	25
Texas	8,813	54	58,162	640	10,946	95
Total	12,107	66	83,840	811	12,879	118

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

the oil pipeline crossings of federal lands in the region occur in Texas (79%). These crossings occur about evenly among lands managed by the NPS (28%), USFS (26%), DOD (25%), and USFWS (20%) (Table 4.10). In Oklahoma, almost all (88%) of the oil pipeline crossings of federal land occur on lands managed by the DOD.

4.2.3 Central Region

4.2.3.1 Land Ownership

The three states of the Central Region are roughly equal in size and have a combined surface area of about 159,000 mi^2 (411,808 km^2) (Table 4.11). Federal lands in the region total about 8,900 mi^2 (23,051 km^2) and account for about 6% of the total area of the region (Figure 4.3). Of the three states in the region, Arkansas has the most federal land (5,453 mi^2 [14,123 km^2]), which accounts for about 11% of the total area of the state (Table 4.11). The largest tracts of federal land in Arkansas occur in the west-central portion of the state and are associated with the Ozark–St. Francis and Ouachita National Forests. Other federal lands in the state include nine NWRs, five military installations, a national memorial, a national military park, and a national river.

Missouri has about 3,100 mi^2 (8,029 km^2) of federal land. Much of this land occurs in the southern portion of the state as part of the Mark Twain National Forest, and across the central portion of the state as the Big Muddy National Fish and Wildlife Refuge, which is located along the Missouri River across much of the width of the state (Figure 4.3). Other federal lands in the state include three military facilities, five NWRs, a national battlefield, and a national scenic river.

Iowa has the smallest amount of federal land of the three states in the region (Table 4.12). Iowa's 290 mi^2 (751 km^2) of federal land represent less than 1% of the total area of the state. Federal land in Iowa includes six NWRs, two military installations, and one national monument. The largest federal parcels in Iowa are the Port Louisa NWR, which is about 108 mi^2 (280 km^2) in size, and the Iowa Army Ammunition plant, which is about 32 mi^2 (83 km^2) in size.

TABLE 4.10 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Lower Great Plains Region, by Federal Agency

	High-Voltage ($\geq$230 kV) Electricity Transmission Lines by State (mi)[c]			Natural Gas Pipelines by State (mi)[c]			$\geq$8-in.-diameter[d] Oil Pipelines by State (mi)[c]		
Agency[a]	KS[b]	TX[b]	OK[b]	KS	TX	OK	KS	TX	OK
USFS	0	4	0	31	115	0	0	25	0
NPS	0	<1	0	5	48	1	0	27	0
BLM	0	<1	0	0	<1	0	0	0	0
USFWS	0	5	0	24	122	6	0	19	0
DOD	2	45	10	40	332	58	0	24	22
TVA	0	0	0	0	0	0	0	0	0
USBR	0	<1	0	5	23	1	0	0	3
DOE	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0
Total	2	54	10	105	640	66	0	95	25

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] KS = Kansas; TX = Texas; OK = Oklahoma.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

TABLE 4.11 Land Ownership in the Central Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Iowa	49,671	290	<1
Missouri	61,661	3,134	5
Arkansas	47,463	5,453	11
Total	158,795	8,877	6

[a] To convert mi^2 to km^2, multiply by 2.590.

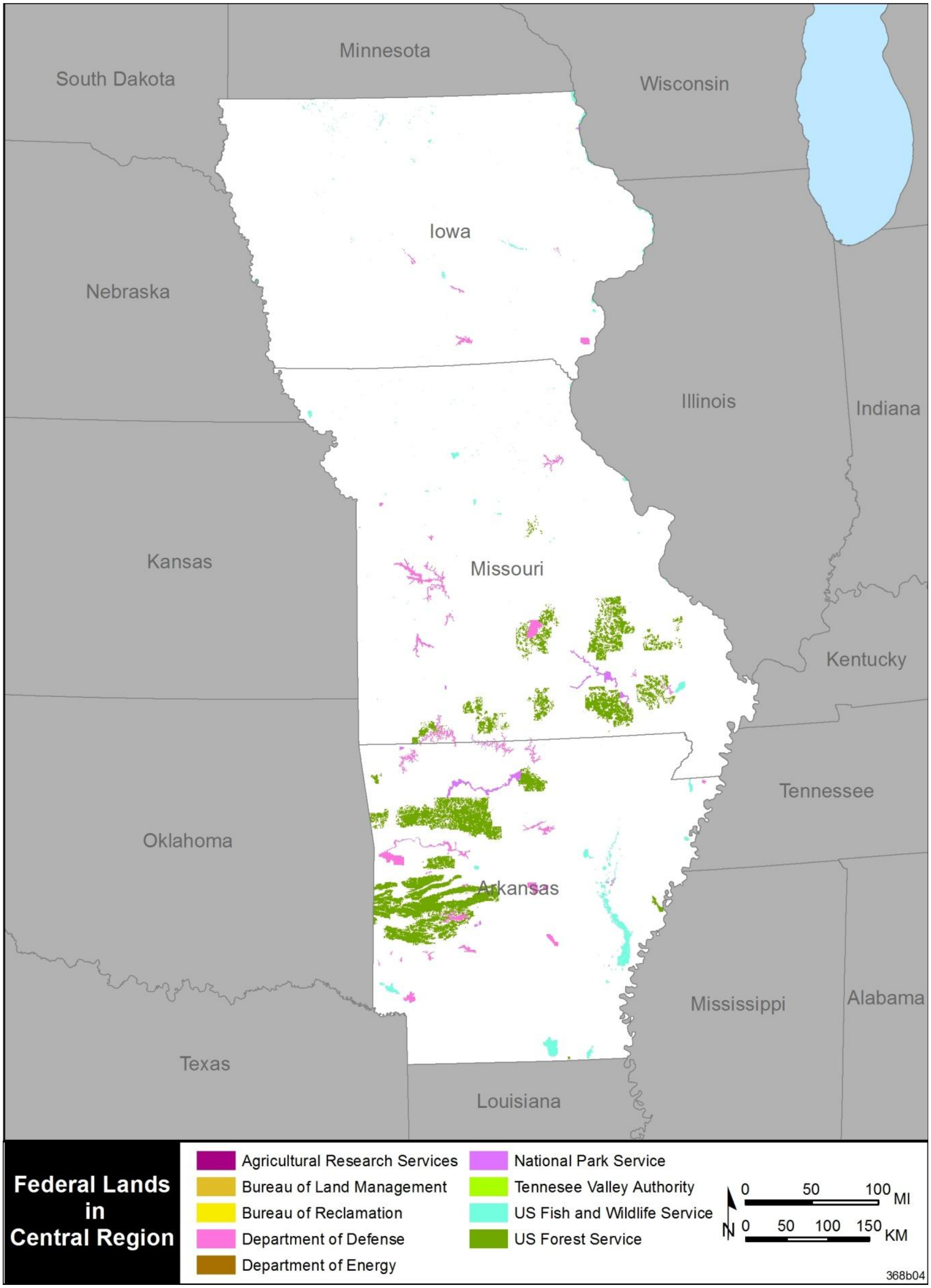

FIGURE 4.3 Federal Lands in the States of the Central Region

TABLE 4.12 Total Linear Miles of Energy Transport Infrastructure in the Central Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.–diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Iowa	1,462	2	7,040	14	220	<1
Missouri	2,174	16	3,953	34	867	12
Arkansas	940	7	6,825	205	545	23
Total	4,576	25	17,818	253	1,632	35

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

4.2.3.2 Energy Transport Infrastructure

While there are more than 24,000 mi (38,624 km) of energy transport infrastructure across the Central Region states, only about 1% (313 mi [504 km]) of that infrastructure occurs on federal land in the region (Table 4.12). Iowa has only about 16 mi (26 km) of infrastructure, and Missouri has 62 mi (100 km) of infrastructure that cross federal land. In contrast, in Arkansas, there are about 235 mi (378 km) of high-voltage electricity transmission lines, natural gas pipelines, and large oil pipelines that occur on federal lands in the state.

High-Voltage Electricity Transmission. There are very few miles (about 25 mi [40 km]) of high-voltage electricity transmission line on federal lands in the region (Table 4.12). In Missouri, most of the crossings occur on NWRs along the Missouri River. In Iowa, the 2 mi (3 km) of high-voltage electricity transmission lines occur on portions of the Port Louisa and Desoto NWRs, while in Arkansas, the infrastructure occurs in the Ozark National Forest and the Cache River and White River NWRs.

Natural Gas Pipelines. About 253 mi (407 km) of federal lands are crossed in the Central Region by natural gas pipelines (Table 4.12). Most of those crossings (about 205 mi [330 km]) occur in Arkansas on lands managed by the USFS, DOD, and USFWS (Table 4.13). Only about 14 mi (23 km) of federal land is crossed in Iowa, mostly (10 mi [16 km]) on USFWS land. Of the 34 mi (55 km) of federal land crossed by natural gas pipelines in Missouri, 27 mi (43 km) occur on USFWS-managed lands.

Large Oil Pipelines. Large oil pipelines occur on only about 35 mi (56 km) of federal land in the Central Region (Table 4.12). Less than 1 mi (2 km) of federal land is crossed by oil pipelines in Iowa (Table 4.13). In Missouri, oil pipelines occur on about 12 mi (19 km) of federal land, almost all of which is land managed by the USFS. There are about 23 mi (37 km) of oil pipeline crossing federal lands in Arkansas, mostly on USFS lands and some USFWS and DOD lands.

TABLE 4.13 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Central Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]			Natural Gas Pipelines by State (mi)[c]			>8-in.-diameter[d] Oil Pipelines by State (mi)[c]		
Agency[a]	IA[b]	MO[b]	AR[b]	IA	MO	AR	IA	MO	AR
USFS	0	16	0	0	27	89	0	11	14
NPS	0	0	0	0	0	0	0	0	0
BLM	0	0	0	0	0	0	0	0	0
USFWS	2	0	4	10	<1	41	<1	<1	6
DOD	0	0	3	4	7	75	0	0	3
TVA	0	0	0	0	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0
Total	2	16	7	14	34	205	<1	12	23

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] IA = Iowa; MO = Missouri; AR = Arkansas.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

4.2.4 Great Lakes Region

4.2.4.1 Land Ownership

The Great Lakes Region is the largest of the nine regions in the lower Section 368(b) states, with a land area of about 377,104 mi^2 (976,695 km^2) (Table 4.14). Areas of individual states in the region range from about 31,950 mi^2 (82,750 km^2) for Indiana, to more than 75,000 mi^2 (194,249 km^2) for Minnesota. There are relatively few federal lands in the region; these total about 18,500 mi^2 (47,915 km^2), which represents about 5% of the total area of the region (Figure 4.4). New York has the smallest amount of federal land (410 mi^2 [1,062 km^2]), while Minnesota has the largest (about 5,700 mi^2 [14,763 km^2]) (Table 4.14). Federal lands account for about 10% of the state of Michigan, but no more than 8% of any of the other states of the region.

Minnesota and Michigan have the most federal land (5,681 and 5,297 mi^2 [14,714 and 13,719 km^2], respectively) of the eight states that compose the region (Table 4.14). In Minnesota, most of the federal lands occur in the northeastern portion of the state as part of two national forests, while in Michigan, the federal lands are largely in the Upper Peninsula and the north-central portion of the Lower Peninsula (Figure 4.4). Federal lands in Minnesota include 2 national forests, 1 national park, 1 national monument, a national scenic river, a national river and recreation area, 1 national wildlife and fish refuge, and 10 NWRs. Federal lands in the Upper Peninsula of Michigan include two

TABLE 4.14 Land Ownership in the Great Lakes Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Minnesota	75,136	5,681	8
Wisconsin	49,706	2,962	6
Illinois	49,749	1,417	3
Indiana	31,946	727	2
Michigan	51,362	5,297	10
Ohio	36,407	573	2
Pennsylvania	39,973	1,080	3
New York	42,825	410	1
Total	377,104	18,147	5

[a] To convert mi^2 to km^2, multiply by 2.590.

national forests, a national lakeshore, a national historic park, a military base, and one NWR. The Lower Peninsula of Michigan includes four military installations, a national lakeshore, one NWR, and one international wildlife refuge (the Detroit River International Wildlife Refuge).

Most of the almost 3,000 mi^2 (7,770 km^2) of federal land in Wisconsin is associated with the Nicolet and Chequamegon National Forests in the northern portion of the state. Other federal lands in the state include three military installations, a national lakeshore, a national scenic trail, a national scenic river, one national wildlife and fish refuge, and three NWRs. Federal lands total about 1,400 mi^2 (3,626 km^2) and compose only about 3% of the total area of Illinois (Table 4.14). These federal lands occur mostly in the far southern portion of the state and are associated with the Shawnee National Forest. Other federal lands in the state include seven military facilities, two national laboratories, eight NWRs, a national prairie, and a national heritage corridor. As in Illinois, most federal land in Indiana also occurs in the far southern portion of the state. There are fewer than 750 mi^2 (1,943 km^2) of federal land in Indiana (Table 4.14). These lands, which occur largely in the southern portion of the state, include a national forest, a national seashore, a national memorial, three NWRs, and seven military facilities.

There are fewer than 600 mi^2 (1,554 km^2) of federal land in Ohio (Table 4.14), largely associated with national forests in the southern and southeastern portions of the state. Other federal lands include three military facilities, two NWRs, a national park, and a national historical park. Pennsylvania has about 1,000 mi^2 (2,590 km^2) of federal land (Table 4.14), much of which encompasses the Alleghany National Forest in the northeastern part of the state. Other federal lands, which are scattered throughout the state, include eight military facilities, two NWRs, a national recreation area, four national historical sites, two national historical parks, two national memorials, a national battlefield, and a national military park. New York State has the smallest amount of federal land (about 410 mi^2 [1,062 km^2]) of any of the eight states of the Great Lakes Region (Table 4.14). Federal lands in New York are scattered throughout the state and include 10 military facilities, 2 DOE facilities, 4 NWRs, 1 national seashore, 1 national recreation area, 1 scenic and recreational river, 1 national historic park, and 1 national historic site.

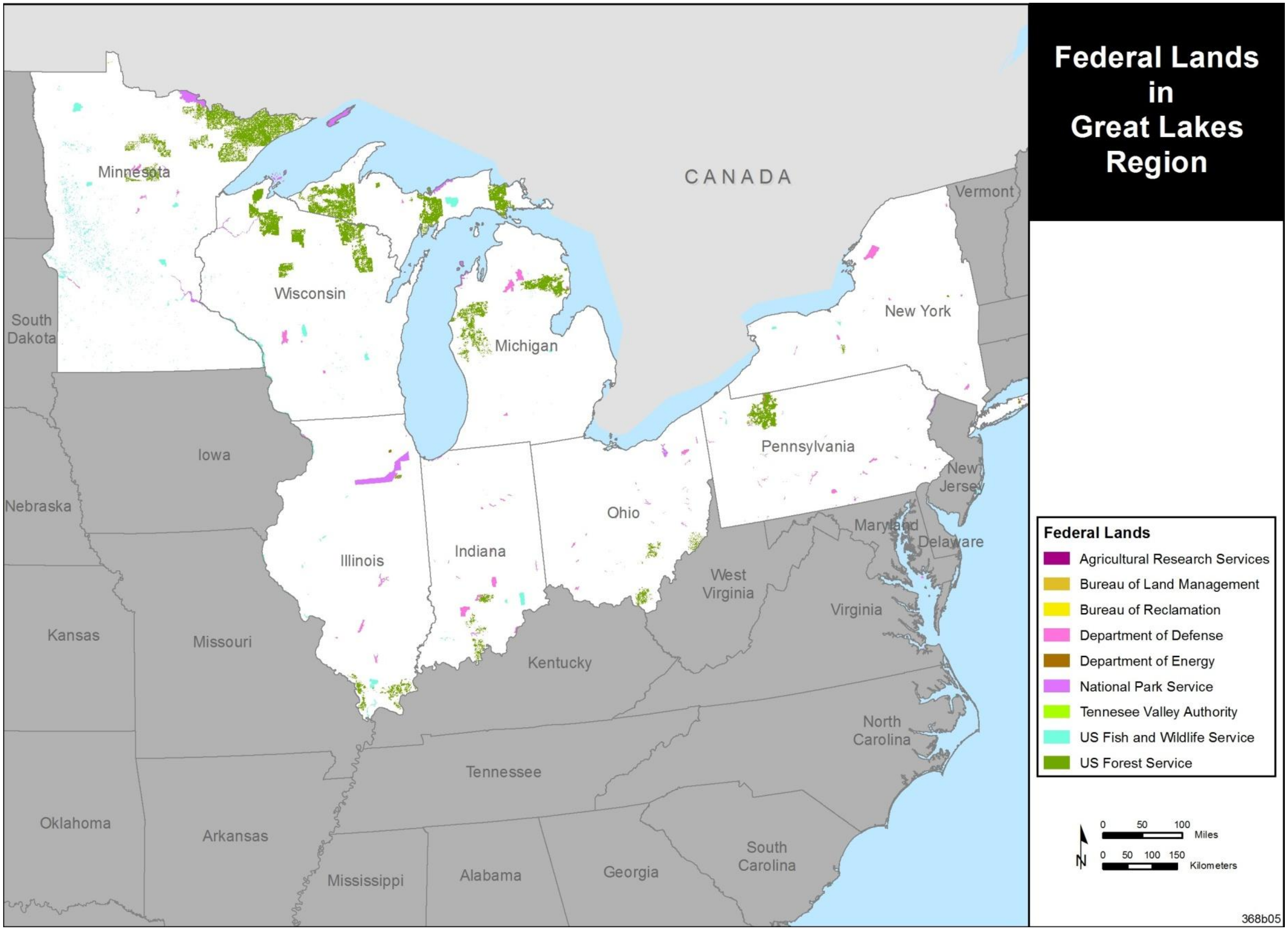

FIGURE 4.4 Federal Lands in the States of the Great Lakes Region

4.2.4.2 Energy Transport Infrastructure

There are about 85,035 mi (136,851 km) of energy transport infrastructure in the Great Lakes Region; about 64% of that infrastructure is used for natural gas transport, 26% is used for electricity transmission, and 10% is used for oil transport (Table 4.15). The amount of electricity transmission infrastructure ranges from about 1,300 mi (2,092 km) in Wisconsin to about 4,100 mi (6,598 km) in Ohio. Natural gas pipelines account for about two-thirds of the energy transport infrastructure, totaling more than 53,000 mi (85,295 km) in the Great Lakes Region (Table 4.15). Within the region, the amount of natural gas pipeline ranges from about 4,000 mi (6,437 km) in New York to about 9,600 mi (15,450 km) in Pennsylvania. Four of the eight states in the region have at least 8,000 mi (12,875 km) of natural gas pipelines.

In contrast to the relatively large numbers of electricity transmission lines and natural gas pipelines in the region, there are fewer than 9,000 mi (14,484 km) of oil pipeline in the region. There is very little oil pipeline (<50 mi [<80 km]) present in either Pennsylvania or New York, while Illinois has the most, about 2,400 mi (3,862 km) of oil pipeline (Table 4.15).

High-Voltage Electricity Transmission. Very little electricity transmission infrastructure occurs on federal lands in the Great Lakes Region (Table 4.15), and the majority of those crossings occur on federal lands managed by the USFS and NPS (76 mi [122 km] of crossings and 209 mi [336 km] of crossings, respectively) (Table 4.16). No more than 3 mi (5 km) of electricity transmission lines cross federal lands in Wisconsin, New York, or Pennsylvania, while Minnesota, Indiana, Ohio, and Michigan each have no more than about 30 mi (49 km) of electricity transmission lines crossing federal lands. Among the Great Lakes Region states, Illinois has the most electricity transmission lines crossing federal land. The 218 mi (351 km)

TABLE 4.15 Total Linear Miles of Energy Transport Infrastructure in the Great Lakes Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Minnesota	1,719	31	5,042	51	1,821	29
Wisconsin	1,304	3	4,009	65	1,043	15
Illinois	2,583	218	8,211	333	2,399	115
Indiana	3,803	20	4,591	70	1,110	3
Michigan	2,921	21	8,164	311	1,298	83
Ohio	4,082	24	9,636	88	897	<1
Pennsylvania	2,769	2	9,393	215	27	<1
New York	2,458	3	4,005	8	42	0
Total	21,639	322	53,051	1,141	8,637	245

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.16 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Great Lakes Region, by Federal Agency

	High-Voltage (≥ 230 kV) Electricity Transmission Lines by State (mi)[c]								Natural Gas Pipelines by State (mi)[c]								>8-in.-diameter[d] Oil Pipelines by State (mi)[c]							
Agency[a]	MN[b]	WI[b]	IL[b]	IN[b]	MI[b]	OH[b]	PA[b]	NY[b]	MN	WI	IL	IN	MI	OH	PA	NY	MN	WI	IL	IN	MI	OH	PA	NY
USFS	0	0	47	3	18	8	0	0	0	52	23	42	254	63	179	0	0	11	7	0	83	0	0	0
NPS	16	1	168	14	0	9	0	1	22	3	288	6	1	14	8	4	12	2	93	1	0	0	0	0
BLM	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USFWS	11	2	0	<1	3	<1	0	1	29	4	3	3	14	<1	2	4	17	2	2	0	0	0	<1	0
DOD	0	0	1	3	0	6	2	0	0	6	13	19	42	10	26	0	0	0	13	2	0	<1	0	0
TVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOE	0	0	2	0	0	0	0	1	0	0	6	0	0	0	0	0	0	0	<1	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	31	3	218	20	21	24	2	3	51	65	333	70	311	88	215	8	29	15	115	3	83	<1	<1	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] MN = Minnesota; WI = Wisconsin; IL = Illinois; IN = Indiana; MI = Michigan; OH = Ohio; PA = Pennsylvania; NY = New York.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

of electricity transmission lines that cross federal lands represent about 8% of the total high-energy electricity transmission infrastructure in the state. The majority of electricity transmission infrastructure that crosses federal lands in Illinois does so at the Illinois and Michigan Canal National Heritage Corridor in northeastern Illinois. This infrastructure is associated with the multiple nuclear generating facilities located south–southwest of Chicago.

Natural Gas Pipelines. There are about 54,000 mi (86,905 km) of natural gas pipeline in the Great Lakes Region (Table 4.15), of which only about 2% (1,141 mi [1,836 km]) cross federal lands in the region. The greatest amount of pipeline crossings on federal land occurs on lands managed by the USFS (613 mi [987 km]), NPS (346 mi [557 km]), and DOD (116 mi [187 km]). Fewer than 10 mi (16 km) of pipeline cross federal lands in New York (Table 4.15). In contrast, Illinois, Michigan, and Pennsylvania have the most miles of pipeline on federal lands (333 mi, 311 mi, and 215 mi [536, 501, and 346 km], respectively) (Table 4.16).

Oil Pipelines. Of the three energy transport systems addressed in this report (high-voltage electricity transmission lines, natural gas pipelines, and oil pipelines), oil pipelines account for the smallest percentage of energy transport infrastructure in the region (Table 4.15). There are only about 8,600 mi (13,840 km) of oil pipeline in the Great Lakes Region, which represent about 10% of the total energy transport infrastructure in the region. Of the oil pipelines in the region, fewer than 250 mi (402 km) cross federal lands in the region (Table 4.15). About half of these crossings occur in Illinois, while few or no oil pipelines cross federal lands in Ohio, Pennsylvania, or New York (Table 4.15). Within the Great Lakes Region, the majority of pipelines on federal lands (85%) occur on NPS- and USFS-managed lands (Table 4.16).

4.2.5 Gulf Coast Region

4.2.5.1 Land Ownership

The Gulf Coast Region has a land area of about 182,400 mi^2 (472,414 km^2), which is split about equally between the four states of the region (Table 4.17). Florida is the largest state (about 52,000 mi^2 [134,680 km^2]), and Louisiana is the smallest (about 41,000 mi^2 [106,190 km^2]).

Federal lands compose only about 7% (about 12,800 mi^2 [33,152 km^2]) of the Gulf Coast Region (Table 4.17). Florida has the most federal land (6,466 mi^2 [16,747 km^2], about 12% of the region), while Alabama has the least federal land (1,751 mi^2 [4,535 km^2], about 4% of the region). The federal lands in the region are widely distributed within each of the four states (Figure 4.5).

TABLE 4.17 Land Ownership in the Gulf Coast Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Louisiana	41,000	2,099	5
Mississippi	42,906	2,495	6
Alabama	46,470	1,751	4
Florida	51,991	6,466	12
Total	182,367	12,811	7

[a] To convert mi^2 to km^2, multiply by 2.590.

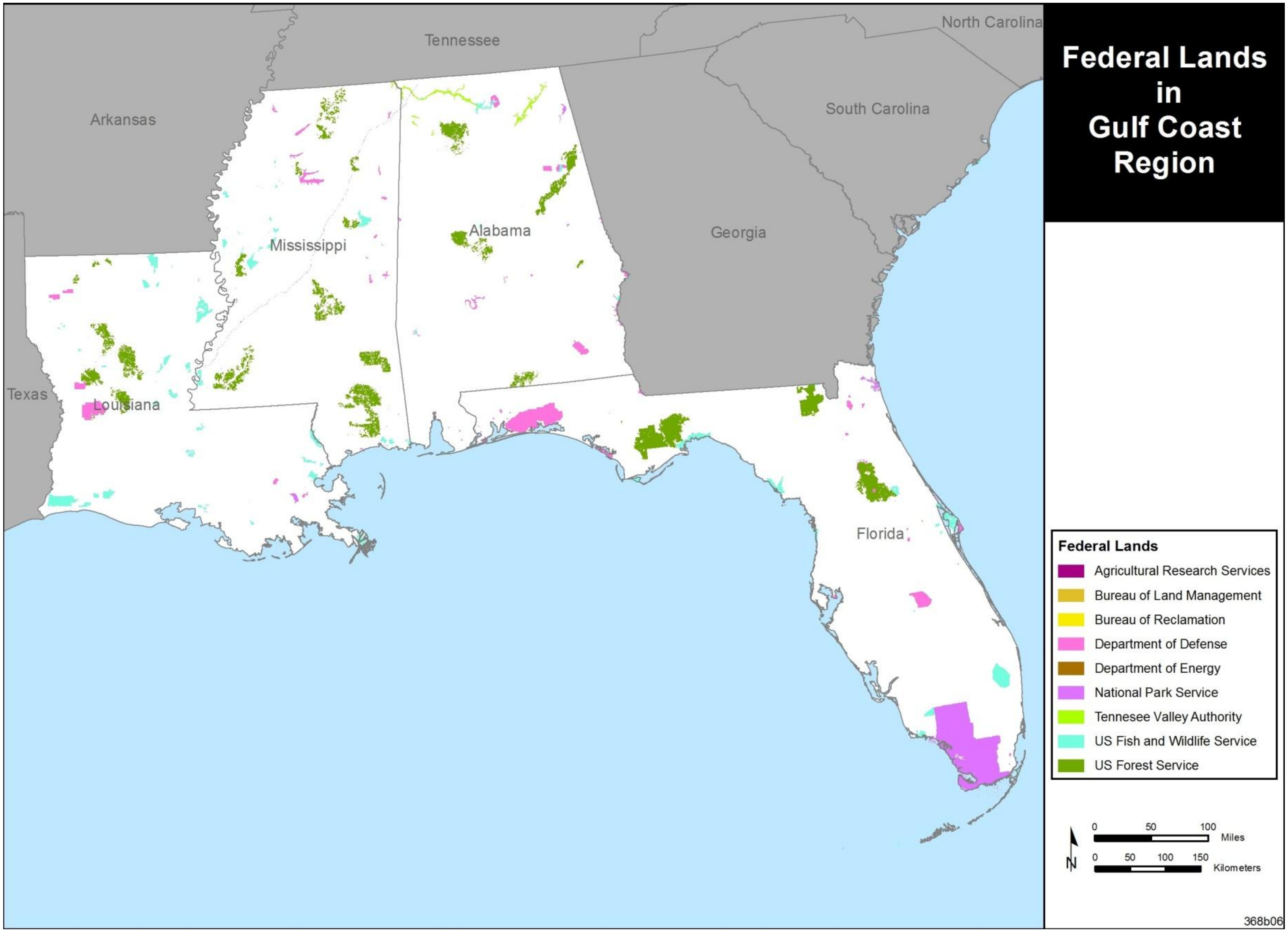

FIGURE 4.5 Federal Lands in the States of the Gulf Coast Region

Federal lands account for about 5% (about 2,100 mi^2 [5,439 km^2] of the area of Louisiana (Table 4.17) and include 22 NWRs, 4 military facilities, a national forest, and 1 national historical park. Mississippi has about 2,500 mi^2 (6,475 km^2) of federal land, which account for about 6% of the total area of the state. Federal lands in Mississippi include 13 NWRs, 6 national forests, 5 military facilities, 1 national seashore, 1 national scenic trail, TVA-managed land associated with Pickwick Lake in the extreme northeastern corner of the state, and a National Aeronautics and Space Administration (NASA) facility.

Alabama has the least amount of federal land of the four Gulf Coast Region states; the 1,751 mi^2 (4,535 km^2) of federal land in the state account for only 4% of the total area of the state (Table 4.17). As with the other states of the region, federal lands are scattered throughout the state, although they are more predominant in the northern half of the state (Figure 4.5). Federal lands in Alabama include 10 NWRs; 9 military facilities; 4 national forests; 1 national military park; 1 national preserve; 1 national trail; and TVA reservoirs along the Tennessee River, Little Bear Creek, Cedar Creek, and Bear Creek in the northern portion of the state.

Florida has the most federal land of the four states in the Gulf Coast Region; the 6,466 mi^2 (16,747 km^2) of federal land account for about 12% of the area of the state of Florida (Table 4.17). While federal lands can be found throughout the state, they tend to be concentrated along coastal areas or associated with a small number of large tracts of federal land managed by the USFS, NPS, and DOD (Figure 4.5). Federal lands in the state include 30 military facilities, 19 NWRs, 3 national forests, 2 national parks, 1 national preserve, 1 national deer refuge, and 1 ecological and historical preserve.

4.2.5.2 Energy Transport Infrastructure

There are about 48,200 mi (77,570 km) of energy infrastructure in the Gulf Coast Region, 85% of which is natural gas pipeline (Table 4.18). Louisiana has the most infrastructure (about 25,000 mi [40,233 km]) and Florida the least (about 5,400 mi [8,690 km]). Among the states of the region, the amount of high-voltage electricity transmission ranges from between 750 and 800 mi (1,207 and 1,287 km) in Alabama and in Mississippi to between 1,100 and 1,200 mi (1,770 and 1,931 km) in Louisiana and in Florida. Natural gas pipelines represent the majority of energy transport infrastructure in each of the states of the region, ranging from about 4,200 mi (6,759 km) in Florida to about 21,500 mi (34,601 km) in Louisiana (Table 4.19). Oil pipelines ($\geq$8-in. [$\geq$20-cm] diameter) account for the smallest amount of energy transport infrastructure in the region. There are no large oil pipelines in Florida, and fewer than 200 mi (322 km) in Alabama (Table 4.18). Mississippi has about 1,100 mi (1,770 km) of large oil pipeline, while Louisiana has the most of any of the states, about 2,200 mi (3,540 km).

High-Voltage Electricity Transmission. There are fewer than 4,000 mi (6,437 km) of high-voltage electricity transmission lines in the region, and very little of that infrastructure (52 mi [84 km], about 1%) occurs on federal land (Table 4.18). No state in the region has more than 16 mi (26 km) of electricity transmission lines crossing federal lands. Federal lands in the region with the most electricity transmission line infrastructure are NWRs managed by the USFWS (about 18 mi [29 km]) and national forests managed by the USFS (about 16 mi [26 km]) (Table 4.19).

TABLE 4.18 Total Linear Miles of Energy Transport Infrastructure in the Gulf Coast Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Louisiana	1,107	16	20,007	1,496	2,158	35
Mississippi	789	14	9,262	224	1,095	70
Alabama	749	13	5,544	64	197	0
Florida	1,175	9	4,026	172	0	0
Total	3,820	52	38,839	1,956	3,450	105

a To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.19 Total Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Gulf Coast Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]				Natural Gas Pipelines by State (mi)[c]				>8-in.-diameter[d] Oil Pipelines by State (mi)[c]			
Agency[a]	LA[b]	MS[b]	AL[b]	FL[b]	LA	MS	AL	FL	LA	MS	AL	FL
USFS	0	11	5	0	396	188	40	138	3	64	0	0
NPS	0	3	0	0	56	6	0	0	11	<1	0	0
BLM	0	0	0	0	0	0	0	0	0	0	0	0
USFWS	9	0	0	9	814	27	4	0	21	5	0	0
DOD	7	0	0	0	230	3	4	34	0	0	0	0
TVA	0	0	9	0	0	0	16	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0	0	0	0
Total	16	14	14	9	1,496	224	64	172	35	70	0	0

a USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

b LA = Louisiana; MS = Mississippi; AL = Alabama; FL = Florida.

c To convert mi to km, multiply by 1.609.

d To convert in. to cm, multiply by 2.540.

Natural Gas Pipelines. Natural gas pipelines represent most of the energy transport infrastructure in the Gulf Coast Region (Table 4.18). Of the approximately 41,000 mi (65,983 km) of natural gas pipeline in the region, only about 5% (about 2,000 mi [3,219 km]) cross federal lands. Alabama has the fewest natural gas pipelines on federal lands (about 64 mi [103 km]), while Louisiana has the most pipeline on federal land (about 1,500 mi [2,414 km]); Florida and Mississippi each have about 200 mi (322 km) of pipeline (Table 4.18). Federal lands with the most natural gas pipelines are those managed by the USFWS (about 845 mi [1,360 km]), USFS (about 762 mi [1,226 km]), and DOD (about 270 mi [435 km]) (Table 4.19).

Oil Pipelines. Oil pipelines account for less than 7% (about 3,555 mi [5,721 km]) of the energy transport infrastructure in the region, and only about 105 mi (169 km) occur on federal land (Table 4.18). No oil pipelines cross federal lands in Alabama or Florida, and only 35 mi (56 km) cross federal land in Louisiana and 70 mi (113 km) in Mississippi. Oil pipelines on federal land occur only on lands managed by the USFS (about 67 mi [108 km] of pipeline), USFWS (about 26 mi [42 km] of pipeline), and NPS (about 11 mi [18 km]) (Table 4.19).

4.2.6 Appalachian Region

4.2.6.1 Land Ownership

The three states of the Appalachian region (Tennessee, Kentucky, and West Virginia) have a combined area of about 94,700 mi^2 (245,272 km^2) (Table 4.20). West Virginia is the smallest of the three states, with an area of about 21,400 mi^2 (55,426 km^2). Kentucky and Tennessee are similarly sized, with areas of approximately 35,800 and 37,500 mi^2 (92,722 and 97,125 km^2), respectively. Federal lands account for only about 7% of the land in this region, and no more than 8% of the land within any single state (Table 4.20). Tennessee has the most federal land of the three states (about 2,950 mi^2 [7,640 km^2]), while West Virginia and Kentucky have similar, smaller amounts (Table 4.20). In general, federal lands in these states tend to be more common in the eastern portions of all three states (Figure 4.6).

Federal lands in Tennessee include four military facilities, four national forests, two DOE facilities, three national battlefields, three national recreation areas, one national river and recreation area, one wild and scenic river, one national park, one national historical park, one

TABLE 4.20 Land Ownership in the Appalachian Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Tennessee	37,487	2,952	8
Kentucky	35,789	1,960	5
West Virginia	21,418	1,828	8
Total	94,694	6,740	7

[a] To convert mi^2 to km^2, multiply by 2.590.

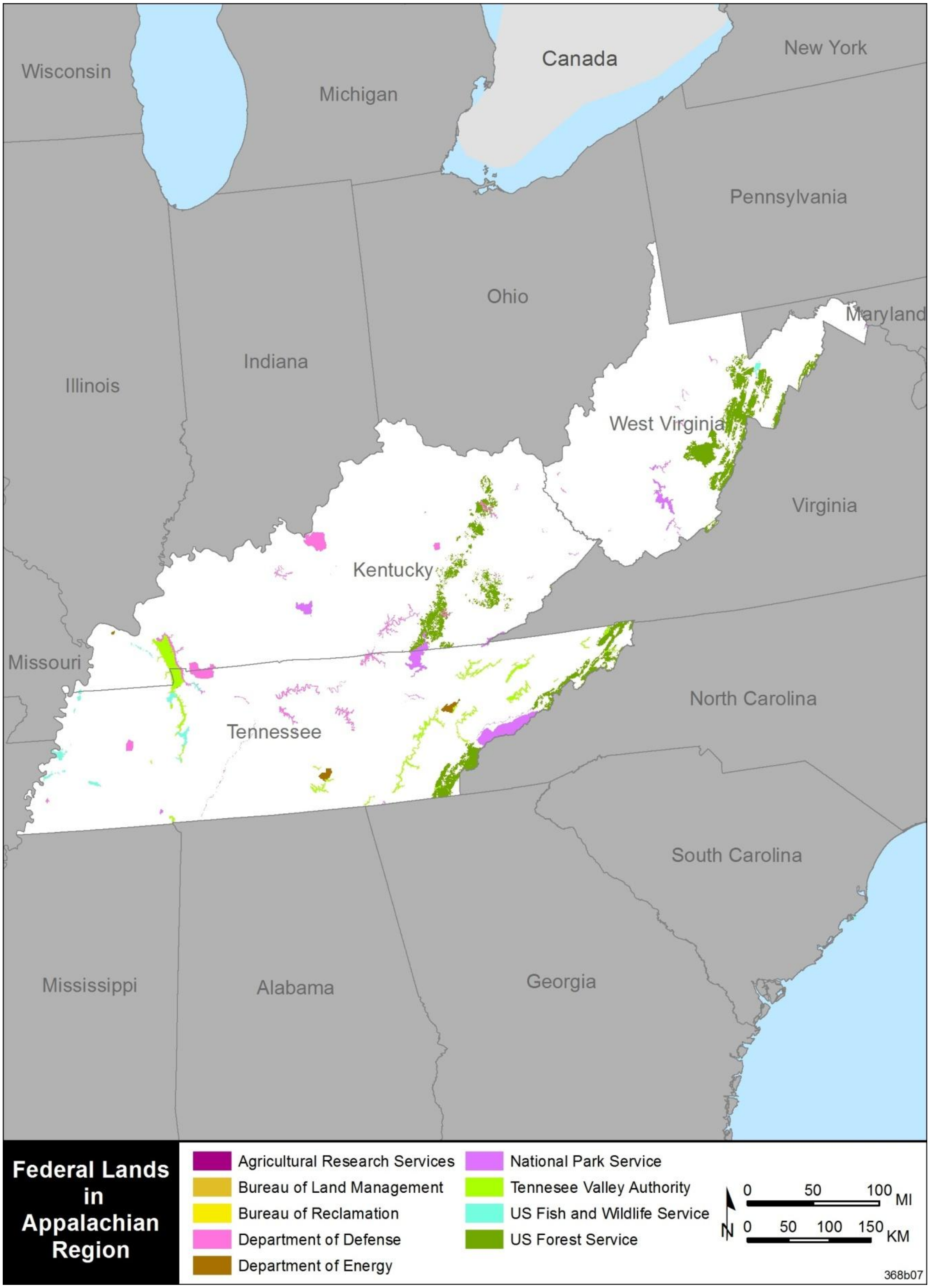

FIGURE 4.6 Federal Lands in the States of the Appalachian Region

national military park, and one national scenic trail. In addition, federal lands in Tennessee include 7 lakes and reservoirs managed by the USACE and 20 lakes and reservoirs managed by the TVA.

Kentucky has about 1,960 mi^2 (5,076 km^2) of federal land, which represents about 5% of the total area of the state (Table 4.20). These federal lands include three military installations, three NWRs, three national forests, one DOE national laboratory, one national park, one national recreation area, one national historic site, one national historical site, and one national river and recreation area. In addition, there are 10 lakes and reservoirs managed by the USACE and 1 lake managed by the TVA.

West Virginia has the smallest amount of federal land (about 1,830 mi^2 [4,740 km^2]) of the three states in the Appalachian Region (Table 4.20). Federal lands in this state are located largely in the eastern portion of the state (Figure 4.6) and include 3 national forests, 2 NWRs, a national scenic river, 1 national river, 1 national historic park, 1 national historical park, and 10 lakes managed by the USACE. The Monongahela National Forest represents the greatest amount of federal land in the state.

4.2.6.2 Energy Transport Infrastructure

The Appalachian Region has about 20,700 mi (33,313 km) of energy transport infrastructure, of which about 74% (about 15,300 mi [24,623 km]) is natural gas pipeline (Table 4.21). There are about 4,480 mi (7,210 km) of high-voltage electricity transmission lines in the three states of the region, and only about 900 mi (1,448 km) of large oil pipeline in the region. While the region has almost 21,000 mi (33,796 km) of energy transport infrastructure, less than 2% (334 mi [538 km]) occurs on federal lands of the region. West Virginia has the smallest amount of energy transport infrastructure on federal lands (<80 mi [129 km]), while Tennessee has the most (about 139 mi [224 km]).

High-Voltage Electricity Transmission. The Appalachian Region has about 4,400 mi (7,081 km) of high-voltage electricity transmission lines, which are about evenly distributed between the three states of the region (Table 4.21). Very little of this infrastructure occurs on federal land (<2%, about 86 mi [138 km]). Only about 4 mi (6 km) of electricity transmission lines in West Virginia, 10 mi (16 km) in Kentucky, and 72 mi (116 km) in Tennessee occur on federal lands. The majority of the transmission lines on federal lands in Tennessee occur on lands managed by the TVA and DOE (Table 4.22).

Natural Gas Pipelines. There are about 15,300 mi (24,623 km) of natural gas pipeline in the three Appalachian Region states, ranging from almost 4,000 mi (6,437 km) in West Virginia to about 6,600 mi (10,622 km) in Kentucky (Table 4.21). As with electricity transmission, very few of the natural gas pipelines (<2%) in the region occur on federal lands. Kentucky has the most crossing of federal lands by natural gas pipelines (about 104 mi [167 km]), while Tennessee has the least (about 66 mi [106 km]). In Kentucky, almost all of the natural gas pipeline crossings of federal land (about 104 mi [167 km]) occur on lands managed by the DOD, the USFS, and the TVA (Table 4.22). In Tennessee, DOD- and DOE-managed lands have the most natural gas pipelines. In contrast, in West Virginia, about 92% (69 of 75 mi [111 of 120 km]) of the natural gas pipelines on federal lands occur on lands managed by a single agency, the USFS (Table 4.22).

Oil Pipelines. There are fewer than 1,000 mi (1,609 km) of oil pipelines in the Appalachian Region states (Table 4.21). Of this infrastructure, less than 1% (about 3 mi [5 km]) occurs on federal lands in the region.

TABLE 4.21 Total Linear Miles of Energy Transport Infrastructure in the Appalachian Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Tennessee	1,642	72	4,461	66	263	1
Kentucky	1,467	10	6,649	104	646	2
West Virginia	1,287	4	3,977	75	10	0
Total	4,396	86	15,087	245	919	3

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.22 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Appalachian Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]			Natural Gas Pipelines by State (mi)[c]			≥8-in.-diameter[d] Oil Pipelines by State (mi)[c]		
Agency[a]	TN[b]	KY[b]	WV[b]	TN	KY	WV	TN	KY	WV
USFS	0	9	2	1	25	69	0	<1	0
NPS	2	<1	2	4	0	1	0	0	0
BLM	0	0	0	0	0	0	0	0	0
USFWS	2	<1	0	9	<1	<1	0	0	0
DOD	6	0	0	32	57	4	0	2	0
TVA	34	0	0	5	21	0	1	0	0
USBR	0	0	0	0	0	0	0	0	0
DOE	28	0	0	15	<1	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0
Total	72	10	4	66	104	75	1	2	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] TN = Tennessee; KY = Kentucky; WV = West Virginia.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

4.2.7 Southern Atlantic Region

4.2.7.1 Land Ownership

The Southern Atlantic Region is represented by Georgia, South Carolina, and North Carolina. This region has an area of about 124,400 mi^2 (322,195 km^2), of which about 9,100 mi^2 (23,569 km^2) is under federal ownership (Table 4.23). South Carolina is the smallest of the three states, with an area of about 25,600 mi^2 (66,304 km^2), while Georgia is the largest, with an area of about 53,000 mi^2 (137,269 km^2). The percentage of federal lands within each of the three states is relatively similar, ranging from about 6.5 to 8.6% (Table 4.23). South Carolina has the smallest amount of federal land (about 1,800 mi^2 [4,662 km^2]), while North Carolina has the largest amount of federal land (3,800 mi^2 [9,842 km^2]).

Federal lands in South Carolina include 10 military installations, 3 reservoirs managed by the USACE, 8 NWRs, 3 national forests, 2 national historic sites, 1 DOE facility, 1 national park, 1 national monument, 1 national battlefield, and 1 national military park. The largest single contiguous federally owned land is the DOE Savannah River Site, which has an area of about 312 mi^2 (808 km^2). The largest amount of federally owned land in the state occurs in the USFS Francis Marion and Sumter National Forests, which totals about 981 mi^2 (2,541 km^2) (about 55% of all federal land in the state), but portions of it also occur in the east-central, northern, and western portions of the state (Figure 4.7).

In Georgia, federal lands account for about 6.6% of the total area of the state. These federal lands include 13 military installations, 9 reservoirs managed by the USACE, 3 national monuments, 2 national historic sites, 1 DOE facility, 1 national recreation area, 1 national military park, 1 national historical site, 1 national seashore, 1 national battlefield, and 1 national forest. The Chattahoochee-Oconee National Forest, which is located throughout the northern portion of the state, accounts for almost 40% of all federal land in the state. North Carolina has the largest amount of federal land of the three Southern Atlantic Region states. These federal lands include 14 military facilities, 4 USACE reservoirs, 11 NWRs, 5 national forests, 2 national seashores, 1 national historic site, 1 national historical site, 1 national military park, 1 national battlefield, 1 national memorial, 1 national park, and the Blue Ridge Parkway. The largest contiguous federal lands in the state are the Great Smokey Mountains National Park (437 mi^2 [1,132 km^2], 12%), the Alligator River NWR (236 mi^2 [611 km^2], 6%), and Fort Bragg (221 mi^2 [572 km^2], 6%).

4.2.7.2 Energy Transport Infrastructure

The South Atlantic Region states have about 13,974 mi (22,489 km) of energy transport infrastructure, the majority of which (83%) is natural gas pipeline (about 11,650 mi

TABLE 4.23 Land Ownership in the Southern Atlantic Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Georgia	52,906	3,490	6.60
North Carolina	43,923	3,800	8.65
South Carolina	27,591	1,800	6.52
Total	124,420	9,090	7.31

[a] To convert mi^2 to km^2, multiply by 2.590.

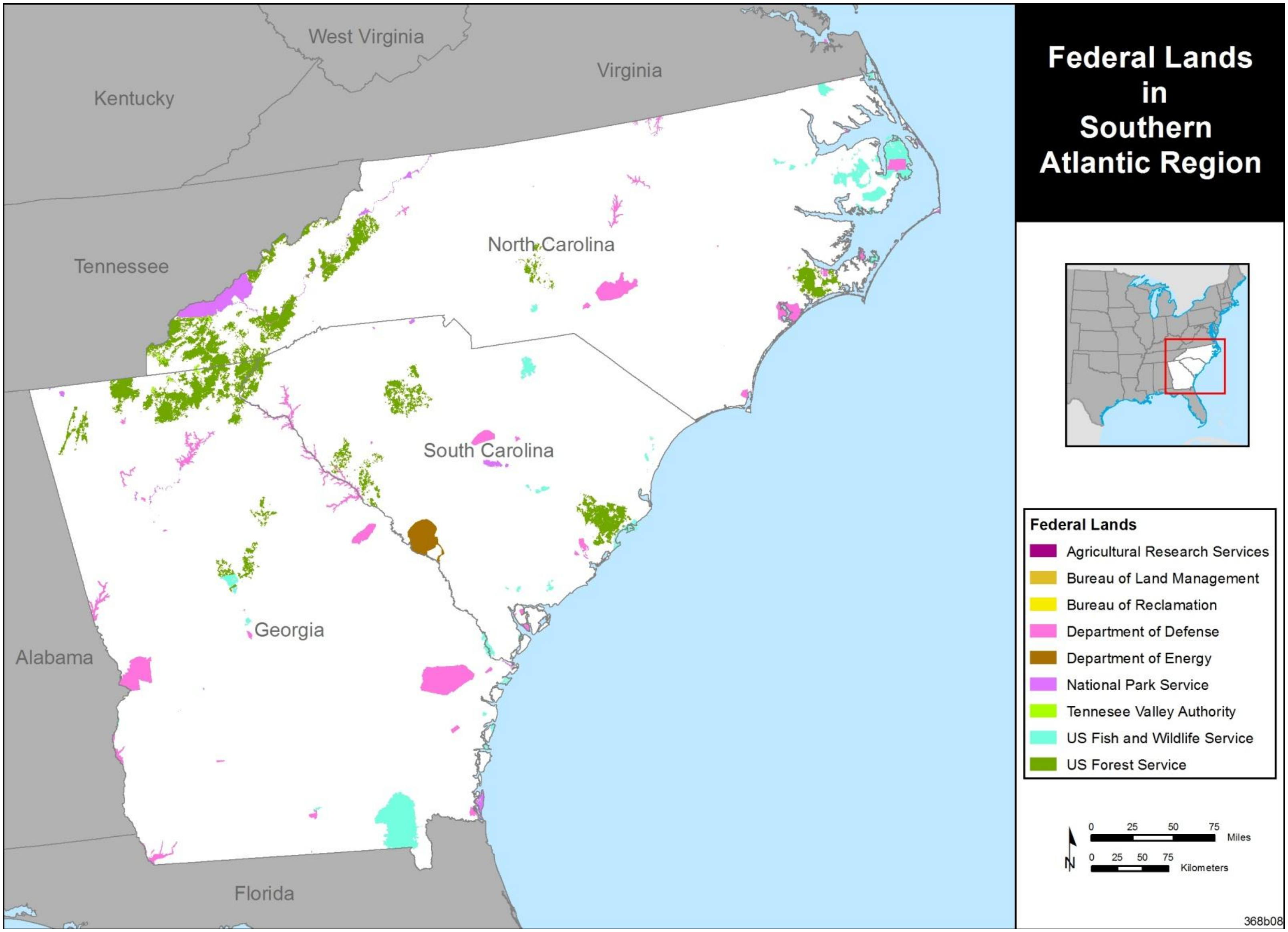

FIGURE 4.7 Federal Lands in the States of the Southern Atlantic Region

[18,749 km]) (Table 4.24). There are no large (≥8-in. [≥20-cm] diameter) oil pipelines in any of the three states of the region. Of the energy transport infrastructure in the region, only about 1% (156 mi [251 km]) occurs on federal lands. Only about 7 mi (11 km) of high-energy electricity transmission line and about 149 mi (240 km) of natural gas pipeline occur on federal lands in the region. Georgia has the smallest amount of energy transport infrastructure on federal lands (about 18 mi [29 km]), while North Carolina has the largest amount (84 mi [135 km]).

High-Voltage Electricity Transmission. There are about 2,300 mi (3,701 km) of high-energy electricity transmission lines in the region, with the majority (62%) occurring in Georgia; North Carolina has the smallest percentage (10%) (Table 4.24). Very little of this infrastructure (about 7 mi [11 km]) occurs on federal land (Table 4.25).

Natural Gas Pipelines. Natural gas pipelines represent the greatest portion of energy transport infrastructure in the region, totaling about 11,648 mi (18,746 km). These pipelines are about evenly distributed among the three states, with individual state totals ranging from 3,760 mi (6,051 km) in South Carolina to about 4,100 mi (6,598 km) in Georgia (Table 4.24). Only about 1% (about 149 mi [240 km]) of these pipelines occur on federal land. Georgia has the smallest amount on federal land (17 mi [27 km]), while North Carolina has the most (82 mi [132 km]). In Georgia, pipeline crossings of federal land are about evenly distributed among the USFS, USFWS, DOD, and NPS lands (Table 4.25). In South Carolina, most (82%) of the natural gas pipeline on federal land occurs on lands managed by the USFS. In North Carolina, there are about 50 mi (80 km) of natural gas pipeline that cross federal lands; these crossings are about evenly distributed between lands managed by the USFS (16 mi [26 km]), USFWS (13 mi [21 km]), and DOD (18 mi [29 km]).

Oil Pipelines. No large (≥8-in. [≥20-cm] diameter) oil pipelines occur in any of the three states of the region (Table 4.24).

TABLE 4.24 Total Linear Miles of Energy Transport Infrastructure in the Southern Atlantic Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Georgia	1,443	2	4,104	17	0	0
North Carolina	238	2	3,784	82	0	0
South Carolina	645	3	3,760	50	0	0
Total	2,326	7	11,648	149	0	0

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.25 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Southern Atlantic Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]			Natural Gas Pipelines by State (mi)[c]			≥8-in.-diameter[d] Oil Pipelines by State (mi)[c]		
Agency[a]	GA[b]	SC[b]	NC[b]	GA	SC	NC	GA	SC	NC
USFS	0	2	0	5	71	16	0	0	0
NPS	1	0	<1	2	0	3	0	0	0
BLM	0	0	0	0	0	0	0	0	0
USFWS	0	0	0	5	3	13	0	0	0
DOD	<1	<1	3	5	8	18	0	0	0
TVA	0	0	0	0	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0
Total	2	2	3	17	82	50	0	0	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] GA = Georgia; SC = South Carolina; NC = North Carolina.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

4.2.8 Mid-Atlantic Region

4.2.8.1 Land Ownership

The Mid-Atlantic Region includes the states of Virginia, Maryland, Delaware, and New Jersey, and the District of Columbia (Figure 4.8). This region has a total land area of about 52,500 mi^2 (135,974 km^2), of which about 8% (about 4,412 mi^2 [11,427 km^2]) is federally managed land (Table 4.26). Among the four states of the region, Virginia is the largest (35,370 mi^2 [91,608 km^2]) and has the most federal land (about 3,800 mi^2 [9,842 km^2]), while Delaware is the smallest (1,739 mi^2 [4,504 km^2]) and has the least amount of federal land (44 mi^2 [114 km^2]). The District of Columbia has a land area of about 54 mi^2 (140 km^2), of which about 22% (12 mi^2 [31 km^2]) is federally managed (Table 4.26). Among the four states, the total amount of federal lands ranges from 2.5% to almost 11% of the land area of any particular state.

Federal lands in Virginia include 29 military installations, 17 NWRs, 6 reservoirs, 5 national historical parks, 4 national forests, 3 national cemeteries, 3 national battlefields, 2 national parks, 2 national monuments, 2 parkways (George Washington Memorial and Blue Ridge), 1 national seashore, 1 national historic park, 1 national memorial, 1 national military park, 1 national historic site, 1 historic landmark

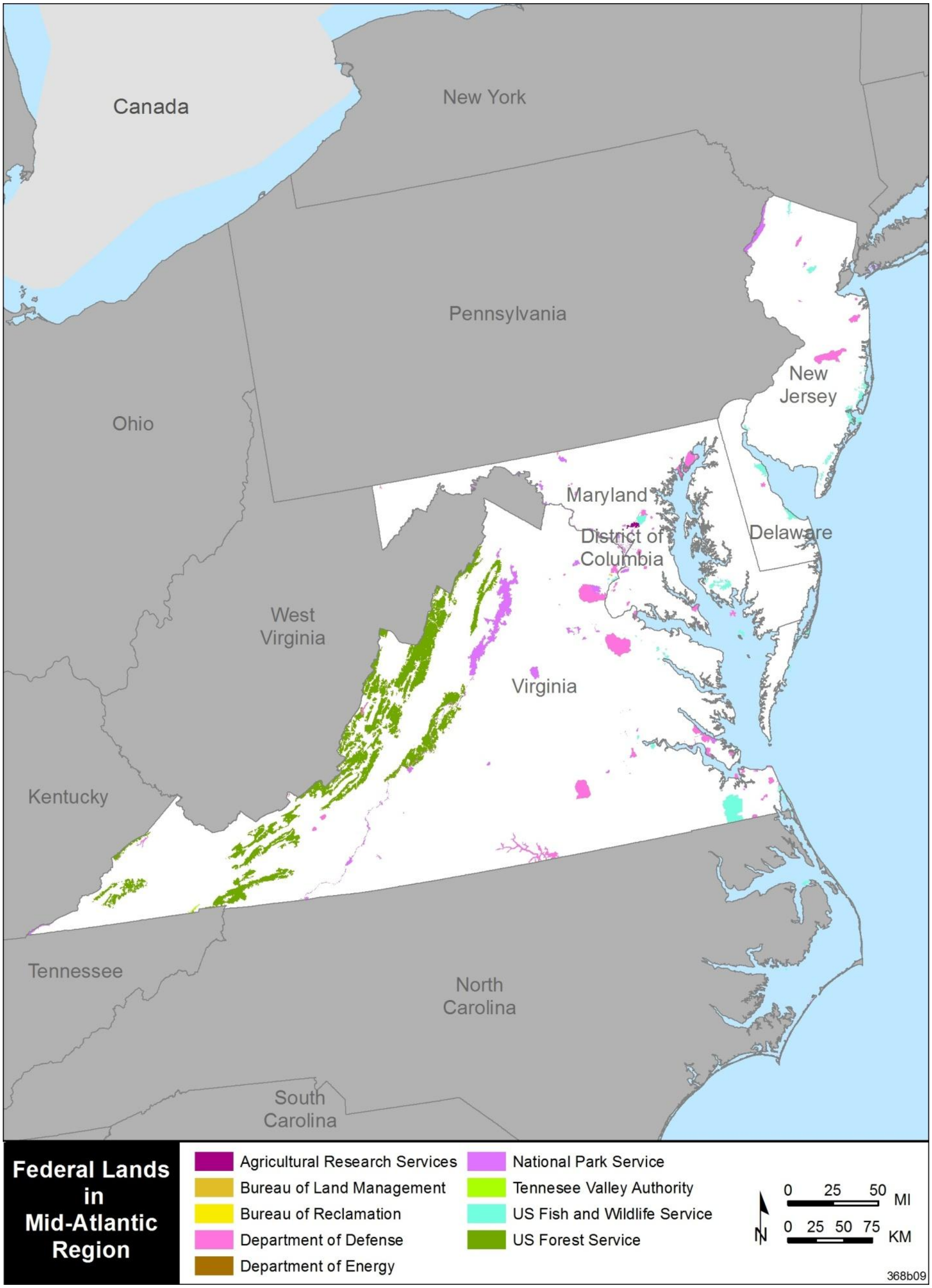

FIGURE 4.8 Federal Lands in the States of the Mid-Atlantic Region

TABLE 4.26 Land Ownership in the Mid-Atlantic Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Virginia	35,370	3,799	10.74
Maryland	8,707	283	3.25
Delaware	1,739	44	2.53
New Jersey	6,631	274	4.13
District of Columbia	54	12	22.22
Total	52,501	4,412	8.40

[a] To convert mi^2 to km^2, multiply by 2.590.

district, and 1 national park for the performing arts. In general, federal lands in Virginia are located along the western and eastern portions of the state (Figure 4.8).

Maryland has the second-largest amount of federal land of the states of the Mid-Atlantic Region, about 283 mi^2 (733 km^2) (Table 4.26). These federal lands include 20 military installations, 10 national Capital parks, 5 NWRs, 5 national parkways, 3 national historic sites, 2 national battlefields, 2 reservoirs, 1 national seashore, 1 national historic park, 1 national monument historic shrine, 1 national historical park, and 1 agricultural research station.

There are about 274 mi^2 (710 km^2) of federally managed lands in New Jersey (Table 4.26). These lands include eight military installations, five NWRs, two national recreation areas, one national historic site, one national historical park, and one national monument.

As previously discussed, Delaware has the smallest amount of federal land (44 mi^2 [114 km^2]) of any of the Mid-Atlantic Region states. These federal lands are represented by Dover Air Force Base (about 4.5 mi^2 [12 km^2]), the Bombay Hook NWR (about 24 mi^2 [62 km^2]), and the Prime Hook NWR (about 16 mi^2 [41 km^2]). All three are located in the eastern portion of the state (Figure 4.8).

The District of Columbia occupies about 54 mi^2 (140 km^2), of which 22% is federally managed land (Table 4.26). Of the 12 mi^2 (31 km^2) of federal land in the District, just under 2 mi^2 (5 km^2) are lands managed by the DOD; the remainder of the federal land is managed by the NPS. Federal lands managed by the NPS include 11 national parkways, 6 national historic sites, 2 national memorials, 1 national cemetery, 1 national historical park, the National Zoo, the Kennedy Center for the Performing Arts, the National Mall, and about 90 small park sites located throughout the District.

4.2.8.2 Energy Transport Infrastructure

There are about 2,680 mi (4,313 km) of high-voltage electricity transmission lines and about 5,180 mi (8,336 km) of natural gas pipeline in the Mid-Atlantic Region; there are no large ($\geq$8-in. [$\geq$20-cm] diameter) oil pipelines in the region (Table 4.27). Of the existing infrastructure, only about 220 mi (354 km) (<3%) occur on federal land.

High-Voltage Electricity Transmission. There are about 2,683 mi (4,318 km) of high-voltage electricity transmission lines in the Mid-Atlantic Region, of which 119 mi (192 km) (about 4%) occur on federal land, and none are in the District of Columbia (Table 4.27). Among the states of the region, there are no high-voltage electricity transmission lines on federal lands in Delaware, and less than 95 mi (153 km) in any of the other three states of the region. The transmission lines that do cross federal lands in the region account for between 2 and 6% of all the high-energy electricity transmission lines in the states.

In Virginia, most (63 mi [101 km], about 69%) of the high-voltage electricity transmission lines that occur on federal land cross lands managed by the USFS; the remainder cross lands managed by the DOD (916 mi [1,474 km], 18%) and USFWS (9 mi [14 km], 10%) (Table 4.28). Less than 3% (17 mi [27 km]) of the high-voltage electricity transmission lines in Maryland cross federal land, and all such lands are managed by the NPS (Table 4.29). Only about 2% (11 mi [18 km]) of the high-voltage electricity transmission lines in New Jersey cross federal land, and all such crossings occur on USFWS-managed land (Table 4.28).

Natural Gas Pipelines. There are approximately 5,182 mi (8,340 km) of natural gas pipeline in the Mid-Atlantic Region, of which less than 2% cross federal land (Table 4.27). Of the four states in the region, Virginia has the most natural gas pipeline (2,690 mi [4,329 km], about 52%) and Delaware the least (264 mi [425 km], about 5%); the District of Columbia has only about 15 mi (24 km) of natural gas pipeline (Table 4.27). While the region has more than 5,000 mi (8,047 km) of natural gas pipeline, only about 100 mi (161 km) (less than 2%) occur on federal land. No pipelines cross federal land in Delaware, while only 3 and 5 mi (5 and 8 km) of pipeline cross federal lands in the District of Columbia and Maryland, respectively. About 79 mi (127 km) of pipeline cross federal land in Virginia, and 15 mi (24 mi) in New Jersey (Table 4.27). In Virginia, about 85% of the 79 mi (127 km) of pipeline on federal land cross lands managed by the USFS (34 mi [55 km]) and NPS (33 mi [53 km]) (Table 4.28). In any of the other states of the region, there are no more than 8 mi (13 km) of natural gas pipeline crossing lands managed by any single federal agency (Table 4.28).

TABLE 4.27 Total Linear Miles of Energy Transport Infrastructure in the Mid-Atlantic Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
States	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Virginia	1,470	91	2,611	79	0	0
Maryland	571	17	845	5	0	0
Delaware	34	0	264	0	0	0
New Jersey	489	11	1,345	15	0	0
District of Columbia	0	0	15	3	0	0
Total	2,564	119	5,080	102	0	0

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.28 Total Linear Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the Mid-Atlantic Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]					Natural Gas Pipelines by State (mi)[c]					>8-in.-diameter[d] Oil Pipelines by State (mi)[c]				
Agency[a]	VA[b]	MD[b]	DE[b]	NJ[b]	DC[b]	VA	MD	DE	NJ	DC	VA	MD	DE	NJ	DC
USFS	63	0	0	0	0	34	0	0	0	0	0	0	0	0	0
NPS	3	17	0	0	0	33	3	0	<1	3	0	0	0	0	0
BLM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
USFWS	9	0	0	11	0	7	0	0	8	0	0	0	0	0	0
DOD	16	0	0	0	0	4	2	0	6	0	0	0	0	0	0
TVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	91	17	0	11	0	79	5	0	15	3	0	0	0	0	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] VA = Virginia; MD = Maryland; DE = Delaware; NJ = New Jersey; DC = District of Columbia.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

4.2.9 New England Region

4.2.9.1 Land Ownership

The New England Region has a land area of about 57,940 mi^2 (150,064 km^2), of which only about 4% (2,302 mi^2 [5,962 km^2]) consists of federal lands (Table 4.29; Figure 4.9). Rhode Island is the smallest state in the region (about 952 mi^2 [2,466 km^2]), while Maine is the largest (about 28,800 mi^2 [74,592 km^2]). New Hampshire and Vermont have the highest percentages of federal land among the states in this region (about 15% and 8%, respectively); federal lands compose less than 2% of the total area of any of the other four states of the region. Federal lands in Connecticut total about 7 mi^2 (18 km^2), accounting for less than 0.2% of the total area of the state, and the smallest amount of federal land of the six states in the region (Table 4.29).

Federal lands in this state include two lakes managed by the USACE, one NWR, one national fish and wildlife refuge, one national historic site, and the New London Submarine Base. There are only about 8 mi^2 (21 km^2) of federal land in Rhode Island (Table 4.29). In this state, federal lands are represented by four NWRs, two military facilities, and a national memorial.

Federal lands account for less than 2% of the total area of Massachusetts, totaling about 130 mi^2 (337 km^2) (Table 4.29). The federal lands in this state include 11 NWRs, 7 military installations, 6 national historic sites, 4 national historical parks, 1 USACE-managed lake, 1 national seashore, 1 national recreation area, and 1 national forest. The largest contiguous federal lands are found in the Cape Cod National Seashore (about 42 mi^2 [109 km^2]) and Otis Air Force Base (about 32 mi^2 [83 km^2]).

While Maine is the largest of the New England Region states (almost 28,800 mi^2 [74,592 km^2]), less than 1% (about 282 mi^2 [730 km^2]) of the area of the state consists of federally managed lands (Table 4.29). Federal lands in the state include nine NWRs, four military installations, a federal waterfowl production area, one national park, one international historic site, and one national forest. The largest contiguous federal lands are the Moosehorn NWR (about 45 mi^2 [117 km^2]), Acadia National Park (60 mi^2 [155 km^2], and the White Mountain National Forest (83 mi^2 [215 km^2]).

Approximately 8% (about 670 mi^2 [1,735 km^2]) of Vermont consists of federal land. These federal lands include two military facilities, two national forests, one USACE-managed lake, one NWR, one national fish and wildlife refuge, and one national historical park. The Green Mountain and Finger Lakes National Forests, located in the south-central portion of the state (Figure 4.9), total about 598 mi^2

TABLE 4.29 Land Ownership in the New England Region

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Connecticut	4,367	7	<1
Rhode Island	952	8	<1
Vermont	8,507	671	8
New Hampshire	8,192	1,204	15
Maine	28,786	282	<1
Massachusetts	7,139	130	2
Total	57,943	2,302	4

[a] To convert mi^2 to km^2, multiply by 2.590.

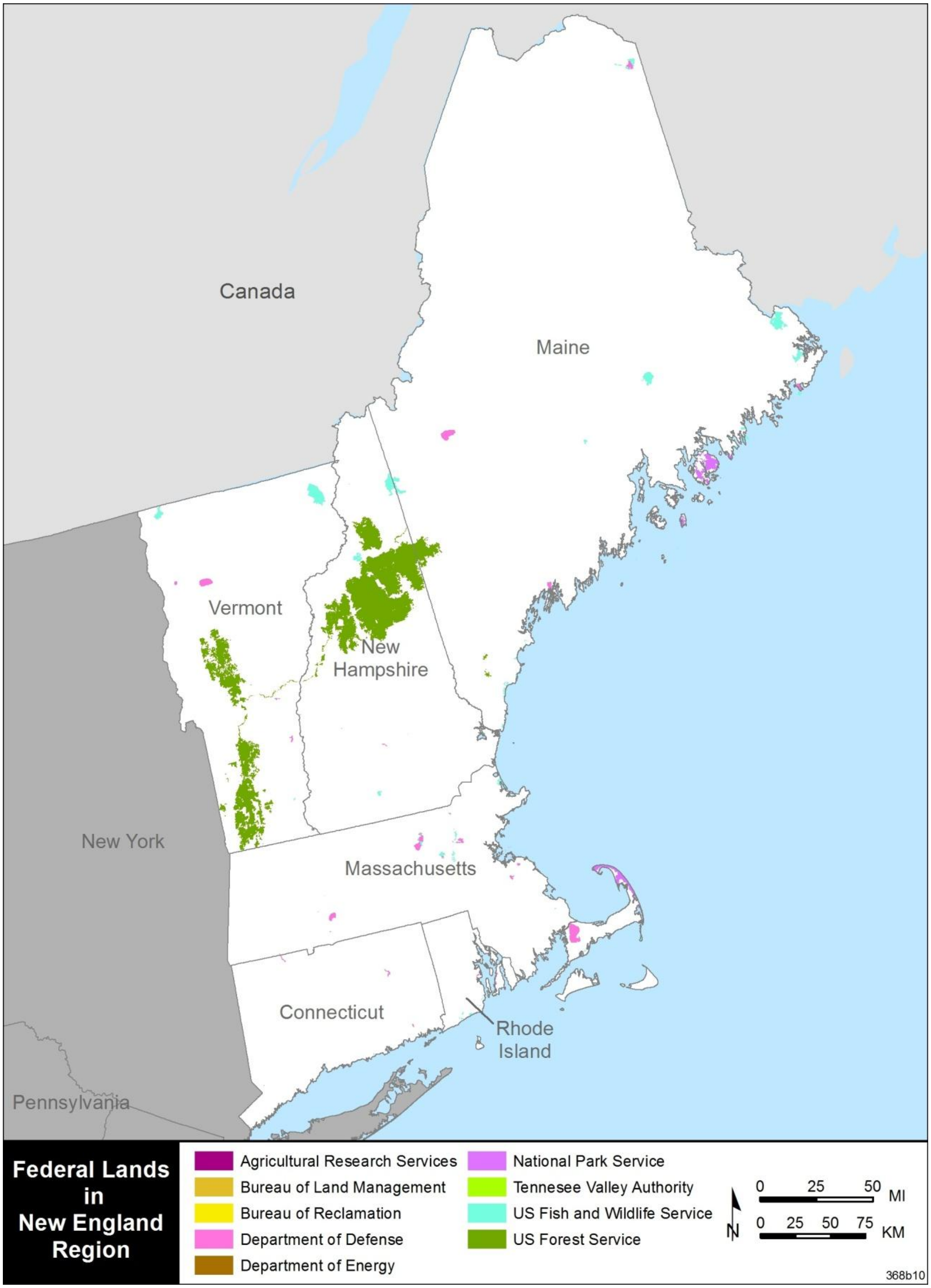

FIGURE 4.9 Federal Lands in the States of the New England Region

($1{,}549\ km^2$) in size and account for 89% of all the federal land in the Vermont.

New Hampshire has the most federal land of any of the states in the New England Region (Table 4.29). These federal lands represent about 15% of the total area of the state. Federal lands in New Hampshire include four national fish and wildlife refuges, one USACE-managed reservoir, one national fish and wildlife refuge, one national historic site, and the White Mountain National Forest. This forest, located in the north-central portion of the state (Figure 4.9), is about $1{,}168\ mi^2$ ($3{,}025\ km^2$) in area and accounts for almost 97% of all federal land in the state.

4.2.9.2 Energy Transport Infrastructure

The New England Region has about 2,350 linear miles (3,782 km) of high-voltage electricity transmission lines and 2,287 linear miles (3,681 km) of natural gas pipelines; there are no large (≥8-in. [≥20-cm] diameter) oil pipelines in the region (Table 4.30). Of this infrastructure, only about 45 mi (72 km) (<1%) occur on federal land.

High-Voltage Electricity Transmission. Less than 2% of the high-voltage electricity transmission lines in the region cross federal land (Table 4.30). There are no high-voltage transmission lines on federal land in Rhode Island, and less than 1 mi (2 km) of federal land is crossed in Connecticut (Table 4.31). Massachusetts, New Hampshire, and Maine each have 10 mi (16 km) or less of transmission lines on federal lands. Of the 36 mi (58 km) of high-voltage transmission lines that cross federal lands in the region, 16 mi (26 km) (47%) occur on lands managed by the USFWS in Vermont and in Massachusetts; 9 mi (14 km) (25%) occur on DOD-managed lands (Table 4.31).

Natural Gas Pipelines. Fewer than 0.5% of the natural gas pipelines that occur in the New England Region cross federally managed lands (9 of 2,278 mi [14 of 3,666 km]) (Table 4.30). No pipelines cross federal lands in either Connecticut or Rhode Island, and only 2 mi (3 km) or fewer of crossings occur in New Hampshire, Maine, and Vermont. Massachusetts has the most natural gas pipeline on federal land of any of the states in the region, but these

TABLE 4.30 Total Linear Miles of Energy Transport Infrastructure in the New England Region

	Energy Transport Type[a]					
	≥230-kV Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Connecticut	399	<1	530	0	0	0
Rhode Island	88	0	87	0	0	0
Vermont	174	16	64	2	0	0
New Hampshire	466	6	223	1	0	0
Maine	477	4	403	<1	0	0
Massachusetts	710	10	971	6	0	0
Total	2,314	36	2,278	9	0	0

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

TABLE 4.31 Total Miles of Electricity Transmission Lines, Natural Gas Pipelines, and Oil Pipelines in the New England Region, by Federal Agency

	High-Voltage (≥230 kV) Electricity Transmission Lines by State (mi)[c]						Natural Gas Pipelines by State (mi)[c]						>8-in.-diameter[d] Oil Pipelines by State (mi)[c]					
Agency[a]	CT[b]	RI[b]	VT[b]	NH[b]	ME[b]	MA[b]	CT	RI	VT	NH	ME	MA	CT	RI	VT	NH	ME	MA
USFS	0	0	<1	6	0	0	0	0	0	1	<1	0	0	0	0	0	0	0
NPS	0	0	0	0	0	<1	0	0	0	0	0	<1	0	0	0	0	0	0
BLM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USFWS	0	0	16	0	4	<1	0	0	0	<1	0	<1	0	0	0	0	0	0
DOD	<1	0	0	0	0	9	0	0	2	0	0	5	0	0	0	0	0	0
TVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AG RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	<1	0	16	6	4	10	0	0	2	1	<1	6	0	0	0	0	0	0

[a] USFS = U.S. Forest Service; NPS = National Park Service; BLM = Bureau of Land Management; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; TVA = Tennessee Valley Authority; USBR = U.S. Bureau of Reclamation; DOE = U.S. Department of Energy; AG RES = Department of Agriculture Research Station.

[b] CT = Connecticut; RI = Rhode Island; VT = Vermont; NH = New Hampshire; ME = Maine; MA = Massachusetts.

[c] To convert mi to km, multiply by 1.609.

[d] To convert in. to cm, multiply by 2.540.

crossings total only 6 mi (10 km) in length, and most cross DOD-managed land (Table 4.31).

4.2.10 Alaska and Hawaii

4.2.10.1 Land Ownership

Alaska is the largest state in the United States, with a total land area of approximately 581,052 mi^2 (1,504,918 km^2), of which about 58% is federal land (Table 4.32). The USFWS manages the largest amount of federal land, about 39% (about 131,108 mi^2 [339,569 km^2]) of all such land in the state (Table 1.1). These USFWS lands are located predominantly in the northeastern and southwestern portions of the state (Figure 4.10). The NPS is the second-largest federal land manager in the state (85,444 mi^2 [221,299 km^2]); these lands are located throughout the state. The BLM is the third-largest federal land manager in Alaska, with about 79,337 mi^2 (205,482 km^2) of land, primarily in the northwestern and central portions of the state.

Federal lands in Alaska include 28 military facilities, 16 NWRs, 11 wilderness areas, 9 national parks, 9 national preserves, 2 national forests, 2 national monuments, 1 national historical park, and 1 wild and scenic river.

Hawaii has a total land area of about 6,383 mi^2 (16,532 km^2), of which about 12.5% (about 800 mi^2 [2,072 km^2]) are federally managed (Table 4.32). The NPS and DOD have the most federal land in Hawaii (624 and 103 mi^2 [1,616 and 267 km^2], respectively). The majority of the NPS land is found on the islands of Hawaii and Maui, while the DOD-managed lands occur primarily on the island of Oahu (Figure 4.10). Federal lands in Hawaii include 26 military facilities, 9 NWRs, 5 national parks, 3 administrative sites, and 1 national historic site.

4.2.10.2 Energy Transport Infrastructure

High-Voltage Electricity Transmission. No high-voltage electricity lines occur in Hawaii. There are about 775 mi (1,247 km) of high-voltage electricity transmission lines in Alaska, of which about 35% cross federal land (Table 4.33). High-voltage transmission lines in the state occur between Anchorage and Fairbanks and in the Kenai Peninsula. Federal lands crossed by these transmission lines are primarily USFS lands in the Kenai Peninsula.

Natural Gas Pipelines. There are about 1,660 mi (2,671 km) of natural gas pipeline in Alaska, of which about 26% (439 mi [707 km]) cross federal lands (Table 4.33). There are only about 22 mi (35 km) of natural gas pipeline in Hawaii, of which 2 mi (3 km) occur on federal land in the state (Table 4.33).

Oil Pipelines. There are no large (>8-in. [≥20-cm] diameter) oil pipelines in Hawaii (Table 4.33). There are about 988 mi (1,590 km)

TABLE 4.32 Land Ownership in Alaska and Hawaii

State	Total Land Area (mi^2)[a]	Federal Land Area (mi^2)[a]	% Contribution of Federal Land
Alaska	581,052	336,444	58
Hawaii	6,383	797	12

[a] To convert mi^2 to km^2, multiply by 2.590.

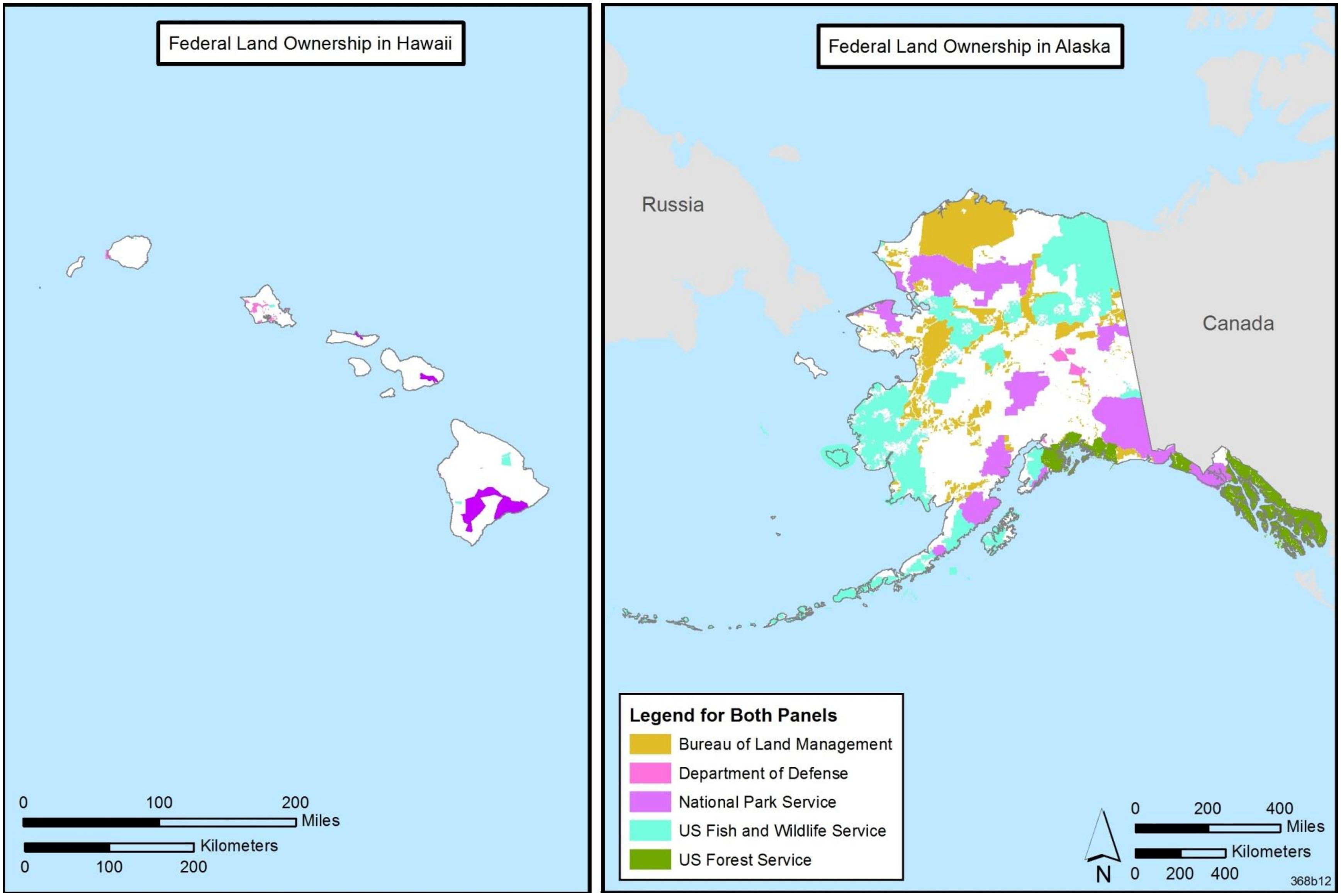

FIGURE 4.10 Federal Lands in Hawaii and Alaska

TABLE 4.33 Total Linear Miles of Energy Transport Infrastructure in Alaska and Hawaii

	Energy Transport Type[a]					
	High–Voltage (>230 kV) Electricity Transmission Line (mi)		Natural Gas Pipeline (mi)		>8-in.-diameter Oil Pipeline (mi)	
State	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land	Non-Federal Land	Federal Land
Alaska	506	269	1,221	439	687	301
Hawaii	0	0	20	2	0	0
Total Lands	506	269	1,241	441	687	301

[a] To convert mi to km, multiply by 1.609; to convert in. to cm, multiply by 2.540.

of large oil pipeline in Alaska, about 30% (301 mi [484 km]) of which cross federal land. Most of the large-diameter pipeline in the state is the Trans Alaska pipeline (about 800 mi [1,287 km] in length), which connects the North Slope of Alaska to the Port of Valdez.

4.3 SUMMARY

The 368(b) states have a total land area of about 2,210,192 mi^2 (5,724,371 km^2), of which 417,410 mi^2 (1,081,087 km^2) are federally managed lands. Of these federal lands, about 81% occur in Alaska, less than 0.2% in Hawaii, and the remaining 19% in the lower 368(b) states (Table 1.1). While the 368(b) states have thousands of miles of energy transport infrastructure, very little of the high-voltage electricity transmission (<2%), natural gas pipeline (<2%), and large oil pipeline (<3%) infrastructure actually crosses federal lands (Table 4.2). The overall absence of long-distance energy transport infrastructure on federal lands in the 368(b) states is likely due to (1) the small size of many of the lands, (2) the general absence of adjoining federally managed lands, and (3) the resource management requirements and use restrictions on federal lands that are incompatible with energy transmission development.

With the exception of federal lands in Alaska, many of the federal lands in the 368(b) states are relatively small. While some federal lands are large with regard to designation, ownership, and management, these large parcels are often composed of multiple smaller parcels. For example, the Mark Twain National Forest incorporates at least seven separate parcels located throughout the central and southern portions of the state (Figure 4.3). In addition, many of these smaller parcels are a patchwork of USFS and non-federal land. Securing ROWs across such patchworks is difficult, and many proponents of future projects may be expected to seek ROWs solely on non-federal land unless there are no other alternative routes for the proposed project.

Federal lands in lower Section 368(b) states are widely scattered, with few shared boundaries (Figures 1.1 and 1.3). For example, the Upper Great Plains Region (North Dakota, South Dakota, and Nebraska) has the most federal land in terms of both total area (almost 29,000 mi^2 [75,110 km^2]) and percentage of all land in the region (14%). However, with the exception of some USFS land in the western portions of the Dakotas, the federal lands are relatively dispersed and separated by non-federal land (with state, Tribal, and/or private ownership) (Figure 4.1). The development of future long-distance energy transmission projects in this region will require extensive crossing of non-federal lands. Depending on the challenges associated with securing ROWs across the non-federal lands, it is highly uncertain whether energy transmission developers would benefit from the presence of short, unconnected energy corridors on federal lands in the region. Future ROWs will likely be sited to minimize development and operational costs (including easement fees to landowners) rather than to take advantage of relatively few and widely spaced corridors that might be designated on federal lands.

Federal lands typically have very specific management responsibilities. These lands include NWRs, national parks, national monuments, and military installations. In each of these types of land, the underlying management responsibilities are intended either for very specific resource conservation or to support military training activities, both of which are largely incompatible with energy transmission infrastructure. For example, many of the federal lands in the lower 368(b) states are managed as NWRs by the USFWS, per the National Wildlife Refuge System Administration Act of 1966. Under this Act, only the USFWS has the authority to approve uses on a NWR, and any uses of a NWR must be compatible with refuge purposes and the mission of the National Wildlife Refuge System (see Section 2.2.3.1). Similar restrictions are associated with federal lands that are designated as Wilderness Areas, National Parks, Wild and Scenic Rivers, USFS roadless areas, and other federal lands. In many of the lower 368(b) states, many of the federal lands have requirements that severely restrict or completely disallow use for energy transmission. In such areas, it is likely that energy transmission planners will seek ROWs that avoid areas with such land use restrictions.

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5 OPPORTUNITIES AND METHODS FOR SITING UTILITY ROWS ON FEDERAL LANDS

5.1 SITUATION

Chapter 2 presents the need for new and upgraded energy transport infrastructure in the eastern states now and in the foreseeable future. Notwithstanding the relative scarcity of federal lands, combined with their fragmented pattern and significant restrictions on the use of many of them for utility ROWs, as well as the non-response to the NOI described in Chapter 1, some projects may intersect federal lands.

5.2 BACKGROUND

In comparison with the western states, where designated energy transport corridors on federal lands provide logical pathways for extending new transmission lines and pipelines across the landscape, the fragmented federal land jurisdiction in the East provides few obvious beacons to attract energy transport infrastructure. Moreover, federal lands administered by the NPS, USFWS, and DOD are usually not available for development of energy transport infrastructure unrelated to the agency mission. Notable exceptions to the generally fragmented pattern of federal lands in the East are some of the more well-blocked lands administered by the USFS in the Northern Great Lakes, the Ozarks, New England, and the Appalachians (Figure 1.1). Although the Agencies are not currently proposing designations, they reserve the right to do so in the future, particularly in these identified areas.

Siting large, long-distance energy transport infrastructure in the East is a complicated task for an applicant and for the entities involved in the application process. In addition to addressing the heterogeneous mix of private, state, and Tribal land ownership, energy transport projects may confront federally controlled lands administered by different land management agencies, each with its own set of rules and procedures for granting ROWs for land uses. As a result, energy transport project applicants must satisfy the often disparate requirements of multiple agencies for the same project.

Most land management agencies have procedures to authorize ROWs on the lands they administer, but because of a generally fragmented ownership pattern, federal land managers seldom have the opportunity to work cooperatively or jointly with other federal agency counterparts to process an application. Local administrative offices (e.g., a national forest) may address energy transport within the boundaries of their administrative areas, and some of these local offices may have identified corridors in their land management plans as the preferred location for energy transport projects (see Energy Transport Corridors text box). In

Energy Transport Corridors

An energy transport corridor is a continuous strip of land of sufficient width to accommodate one or more ROWs for electricity transmission facilities or oil or natural gas pipelines. Energy transport corridors are identified and designated by land management agencies and are distinct from the National Interest Electric Transmission Corridors designated by DOE. A corridor can be multiuse and include both transmission lines and pipelines as well as other compatible uses. Energy corridor designation through land use planning can help guide future energy transmission development to avoid or minimize impacts on natural and cultural resources as well as agency mission objectives. Agencies may decide proactively to designate energy transport corridors in their land use plans in advance of any ROW applications, or reactively in response to one or more applications. Agencies that will benefit the most from designated energy corridors are those with relatively large blocks or contiguous strips of land situated in the pathway of potential energy transport development.

addition, because utility-scale energy development is precluded on all or portions of some federal lands for various reasons, there is at least some indication where development could be considered by avoiding restricted locations. However, these locally identified pathways seldom provide long-distance continuity because of fragmented federal ownership and extensive intervening non-federal jurisdiction.

Under the existing regulatory schemes, the potential benefits of direct, cost-effective, and environmentally favorable routing of an energy transport project in the East may be encumbered. In certain instances, the applicant may face delays because an agency may need to amend its land use plan to include a location for the proposed ROW. These delays may be caused by administrative hurdles, internal analyses, and reviews and approvals required by the local office. The absence of coordinated ROW application processing procedures and adequate coordination among and within agencies has limited the use of federal lands in the East for development of energy infrastructure.

5.3 INTERAGENCY COLLABORATION

Energy transport system developers may view federal lands as targets or stepping stones for defining their routes, or as just another obstacle to the challenge of siting linear facilities for long distances in increasingly crowded conditions. In either case, there are opportunities for the agencies to collaborate and coordinate on their processes for reviewing ROW proposals, as described in the following examples.

5.3.1 Records of Decision

The January 2009 BLM and USFS Records of Decision (RODs) to implement EPAct Section 368(a) in the 11 contiguous western states describe one example of a way to streamline the federal ROW permitting process (BLM 2009; USFS 2009). The improved permitting process directs the agencies to develop uniform interagency operating procedures (IOPs), which will be applicable across administrative boundaries and among different federal agencies, to process applications for permits to develop long-distance energy transport infrastructure. Implementation of the IOPs will include the following:

- The federal agencies involved will select a responsible federal official to oversee the processing of the ROW applications;
- The agencies will require a single environmental review for a proposed ROW project;
- The agencies will develop a single cost-share agreement and fee schedule and seek a unified billing process for the applicant; and
- The agencies will undertake other such measures to improve the application process.

The Section 368(a) streamlining process is based on the principles of the Service First program implemented by the BLM, USFS, NPS, and USFWS. Service First was initially a joint BLM and USFS initiative designed to improve customer service by providing streamlined, one-stop shopping across agency jurisdictional boundaries for public land users. Authority for Service First was provided by legislation in 1997 that covered only the BLM and USFS. That legislation was subsequently amended to include the NPS and USFWS. Service First provides legal authority for the USFS, NPS, USFWS, and BLM to carry out shared or joint management activities to achieve mutually beneficial resource management goals. Service First authority has been used primarily for co-locating offices, joint permitting, shared management, and single points-of-contact (POCs) for resource programs. Agencies that are not a part of Service First may join the Service First agencies through necessary agreements in order to process applications. For example, the USBR, Bureau of Indian Affairs

(BIA), and USACE may also seek Service First authority.

Additional information regarding the procedures briefly described above is contained in the BLM and USFS RODs that apply to the designation and management of energy transport corridors on lands administered by both agencies in the West (BLM 2009; USFS 2009). While energy transport corridor designation may not be feasible or appropriate on most federal lands in the East, the principles of interagency coordination and cooperation for streamlining ROW application processing described in the RODs can work well to facilitate project authorizations.

5.3.2 Memorandum of Understanding

A second example of coordination and collaboration is the Memorandum of Understanding (MOU) required by Section 1221 of EPAct and dated October 23, 2009 (USDA et al. 2009). It was signed by several federal agencies to expedite the siting and construction of qualified electric transmission infrastructure throughout the United States. Qualifying projects are defined as high-voltage transmission line projects, which are generally, though not necessarily, 230 kV or above, and their attendant facilities; or otherwise regionally or nationally significant transmission lines and their attendant facilities, in which all or part of a proposed transmission line crosses jurisdictions administered by more than one participating agency.

The purpose of the MOU is to improve coordination among project applicants, federal agencies, and states and Tribes involved in the siting and permitting process. It is expected to improve uniformity, consistency, and transparency by setting forth the roles and responsibilities of these entities when project applicants wish to construct electric transmission infrastructure. The MOU provides for designation of a lead agency to serve as a single POC for the following:

- Coordinating all federal authorizations required to site electric transmission facilities on federal lands;
- Coordinating preparation of unified environmental documentation that will serve as the basis for all federal decisions necessary to authorize the use of federal lands for qualifying projects;
- Coordinating all federal agency reviews necessary for project development and siting; and
- Maintaining a consolidated administrative record of all federal actions taken with respect to a qualifying project.

The MOU describes procedures for lead agencies, including NEPA compliance; participating agencies that are involved because a proposed project would affect land under their jurisdiction; and cooperating agencies that are involved because of their regulatory responsibilities, for example, USFWS consultation under the ESA.

5.4 SITING OF INTERSTATE ELECTRIC TRANSMISSION FACILITIES

Another consideration for federal land management agencies is contained in Section 1221 of EPAct, which became Section 216(a) of the Federal Power Act and requires DOE to designate National Interest Electric Transmission Corridors to relieve energy congestion. The national corridors initially designated by DOE may contain federal lands because they identify broad swaths of congestion built using county boundaries and do not exclude any lands.

Under Section 216, FERC can issue a permit for energy transmission construction within a national corridor if a state does not issue a permit within 1 year. The FERC-issued permit carries with it the power of eminent domain if the land cannot be obtained through negotiations. However, this eminent domain power does not apply to routing of a transmission facility through property owned by the United States or a state. Any permit issued for such property would be subject to the consent of the appropriate federal or state land-managing agency. Thus the FERC permit holder would have no right to undertake utility-scale energy development where it is precluded on all or portions of some federal lands and would still have to obtain a ROW across any federal or state property pursuant to existing federal or state agency land management plans and other requirements.

While the FERC permitting power in Section 216(a) has no real impact on the designation of energy transmission corridors on federal lands, its actions could affect the siting of energy transmission facilities on those lands contained within the broad boundaries of such corridors. Federal agencies should be alert to the designation of national corridors by DOE to relieve energy transmission congestion and the potential need to review their land use plans to identify lands where energy transport facilities could be considered, as well as those where such facilities would be restricted. This would streamline the ROW application process for projects proposed for development within a National Interest Electric Transmission Corridor.

5.5 PROCESS STREAMLINING

Fragmented patterns of federal land jurisdiction in the East, coupled with limited opportunities for utility-scale development on many classes of federal land, make designation of federal energy transport corridors an inefficient solution to resolving energy transmission siting challenges. Instead, coordinated, collaborative ROW application processing by federal land management agencies with current land use plans can be a more effective method to facilitate energy transmission siting. Adoption of the Service First and Section 368(a) One-Stop-Shopping procedures by the federal land management agencies in the East will be a more effective way to address the federal land needs of energy transport projects than traditional agency-by-agency processing or connect-the-dots energy corridor designation. In addition, more proactive land use planning decisions regarding anticipated ROW needs will enable federal land managers to participate efficiently in the coordinated one-stop process with other agencies. Finally, if designation of any National Interest Electric Transmission Corridors under Section 216(a) of the Federal Power Act were to occur, federal land managers should be alert to how such designation could affect lands they administer.

6 CONCLUSION

It is clear that the nation will see continued demand to locate new or expanded energy transmission infrastructure projects. Many of the components that make up the electric infrastructure were designed with an operating life of 40 to 50 years; as some of these components near 100 years of age, local, state, and federal government, as well as businesses, utilities, and the public, are taking notice of the degrading changes in this critical infrastructure. In an age of modernization when terms such as "green power" and "smart grid" and anticipation of large-scale electric vehicle usage have gained widespread attention, the U.S. power system infrastructure requires significant upgrades to meet new challenges introduced by advanced technologies and capabilities. The electric infrastructure will require upgrades if it is to maintain its responsiveness to new energy production sources such as wind and solar generation, and new demand requirements such as electric vehicle applications and customer responses to market conditions. Indeed, NERC recently released a statement indicating that proper frequency regulation is troublesome in the Eastern Interconnect and has been declining since the early 1990s. This condition is a significant concern and highlights a real need for system improvements that will potentially involve both transmission and generation resources.

Five states, Louisiana, New Mexico, Oklahoma, Texas, and Wyoming, currently account for 79% of domestic natural gas production, with the majority recovered from conventional reservoirs. However, the lower 48 states also contain substantial amounts of gas in unconventional reservoirs such as shale formations, coal-bed formations, and tight gas formations, the development of which will require pipeline expansions. For example, companies with existing pipeline infrastructures in the vicinity of the Marcellus shale formation have announced as many as 24 pipeline expansion projects to bring gas from the formation to market. INGAA estimates that in order to meet growing natural gas demand, approximately 28,900 to 61,600 mi (46,510 to 99,136 km) of additional natural gas pipeline will be required in the United States and Canada by 2030. Operational changes and expansion of gas storage capacities will also be necessary to maintain system stability and responsiveness to changing temporal patterns of gas consumption. The expected increase in the use of natural gas for electricity production will change the current cyclical seasonal patterns of gas consumption by increasing summer consumption as the electricity thus produced is used to support residential and commercial cooling.

Recognizing the critical need to enhance and expand the nation's energy transportation infrastructure, Congress set forth various provisions under EPAct that would change the way certain federal agencies coordinate to authorize the use of land for a variety of energy-related purposes. As part of Subtitle F of EPAct, Section 368 addresses the issue of energy transportation corridors for oil, gas, and hydrogen pipelines on federal land, in addition to electricity transmission and distribution facilities. However, Congress also recognized fundamental differences in the amount and type of federal land by dividing Section 368 into two categories: (1) Section 368(a) for the 11 western states, and (2) Section 368(b) for the rest of the states. Within the 39 states addressed by Section 368(b), the federal government administers 21.2% of the total land area, with the USFS, DOD, USFWS, and NPS being the principal land stewards. However, federal land composes a small percentage of the 39 Section 368(b) states in comparison with the high percentage of federal land in the 11 western states. Only 4.8% of the total land area within the eastern states and 12.5% of the total land in Hawaii is federal land, whereas approximately 50% of the land in the 11 western states is federal land. Alaska, whose land area is 58.1% federal, is the one notable exception. As opposed to the 11 western states, where development on federal land is clearly necessary to improve energy delivery to population centers, it is clear that developing a network of Section 368 corridors in all 39 Section 368(b) states, particularly those with relatively few acres of federal land, would not improve energy delivery significantly enough to warrant their designation.

When stakeholders and members of the public were asked to provide input on the need or potential locations for energy corridors on federal lands in the Section 368(b) states, there were relatively few and minor responses by the citizens, state and local government officials, and interested stakeholders to the information requests outlined by the federal agencies in the ANOI. One Tribal government responded to the DOE with a request for information on new corridor locations, but the request was satisfied early in the Section 368(b) process and no further action was required. Other comments received in response to the ANOI focused on environmental and regulatory issues, but these comments did not identify any potential specific or general corridor locations within the Section 368(b) states. The very limited public and/or stakeholder response to the request for information outlined in the ANOI, especially the lack of any potential corridor locations put forth or identified by the public, state and local governments, utilities, or other interested stakeholders, clearly demonstrated the absence of identified, immediate public interest in new corridors on federal land within the Section 368(b) states.

Land use planning on federal land in the Section 368(b) states is a function of each Agency's core mission (including Agency Services and Bureaus). The core mission is implemented through Agency planning goals and objectives that frame and guide decision making on land use actions at the national, regional, and/or local level; core missions are often codified by federal legislation and published regulations, which result in Agency policies and procedures that explicitly direct the suite of possible land uses that can be implemented by Agency decision makers. Therefore, the directives in Section 368(b) must be considered within the context of each Agency's land management responsibilities, goals, policies, and regulations to determine their compatibility or suitability with energy transportation developments on Agency-administered lands. A brief summary of each Agency's general mission highlights the fact that federal lands are not equal when it comes to siting or enhancing energy transportation infrastructure development:

- USFS authorizing legislation allows for a wide range of land use authorizations, including electric transmission and pipeline infrastructure development. Applications for energy infrastructure development on USFS lands are subject to environmental and land use analysis prior to approval and can be denied for a variety of reasons, including a finding that the use could reasonably be accommodated on non-USFS lands.

- NPS lands are managed to protect and enhance nationally important ecological, scenic, recreational, and historic locations. Because of the importance the NPS places on protecting NPS lands from development activities, these lands are not generally available for the installation of new major electrical transmission infrastructure or pipeline infrastructure development.

- The USFWS administers the lands included in the NWRS, which was created to set aside lands and waters to conserve a wide variety of fish, wildlife, and plant species. Individual USFWS refuges are not generally available for installation of major electric or pipeline transmission systems, although the Secretary of the Interior may permit such use whenever he determines that such uses are compatible with the purposes for which these refuges were established.

- DOD-administered lands are used principally (1) to provide basing and training sites for the military services and (2) as part of civil works projects such as flood control and navigation. The DOD does not have a mandate to provide lands for electrical or pipeline transmission infrastructure. However, the USACE administers lands that incorporate civil works projects developed and managed by the USACE, and these lands are frequently committed to recreation, wildlife, port construction, and project operations functions. These lands may be available for location of energy transmission infrastructure if the use is not inconsistent with the purposes for which the land was acquired for each civil works project.

- The TVA operates hydroelectric, coal, and nuclear power generating stations only within the TVA region, within the seven southeastern states. The TVA-managed lands around reservoirs frequently border private lands and are generally managed for public recreation opportunities or providing fish and wildlife habitat.

- USBR-managed lands in the Section 368(b) study area are located in the westernmost tier of six states in the Section 368(b) study area. The USBR has the authority to authorize electric and pipeline transmission facilities on USBR lands.

- The DOE maintains several large reservations within the eastern states, but due to current and past uses, these lands are generally not suited for developing new utility-scale transmission infrastructure.

- The BLM, like the USFS, is a multiple-use agency with a mandate to manage public lands for a wide array of uses, and it has full authority to authorize electrical and pipeline transmission systems consistent with the direction provided in its land use plans. In contrast to the 11 western states, there are limited areas of public land administered by the BLM in the eastern states. The relative scarcity of BLM-administered land in the eastern states limits the proactive role the federal government can play in energy transportation planning and analysis under Section 368(b).

While it is the mission of the USFS to engage in multipurpose land management, and the national forests in the eastern states comprise more than 44,365 mi^2 (114,905 km^2) of land, this land is contained in over 11,000 separate parcels that vary in size from less than 1 to 2,431 mi^2 (3 to 6,296 km^2). USFS lands in the eastern states consist of relatively few large contiguous land areas, and individual national forest units often contain numerous small parcels of federal land intermixed with non-federal land. The heterogeneous ownership patterns impede the USFS in locating corridors on federal lands without affecting a significant number of neighboring non-federal landowners. In addition to the issues of spatial heterogeneity at the individual national forest–unit level, many national forests in the eastern states are separated from other units by hundreds of miles of intervening non-federal land. In addition, the USFS has determined that some USFS land must be managed and utilized for a single value or purpose. Other uses of these lands receive low priority or must closely align with the designated use. These single-purpose lands may be reserved for recreation, wilderness, roadless areas, or unique ecological services or values.

In comparison with the western states, where designated energy transport corridors on federal lands provide logical pathways for extending new transmission lines and pipelines across the landscape, the fragmented federal land jurisdiction in the East provides few obvious beacons to attract energy transport infrastructure. Moreover, federal lands administered by the NPS, USFWS, and DOD are usually not available for development of energy transport infrastructure unrelated to the agency mission. The lack of identified public need, combined with (1) the relatively small amount of federal land in these states (especially compared to the 11 western states) and (2) the often single-priority land use management purposes for these federal lands (e.g., parks, wildlife refuges, trails) results in the Agencies' determination that they would not, at this time, develop a proposed action or decision to identify and designate Section 368(b) energy transportation corridors on federal lands within the Section 368(b) states. The Agencies have determined that decisions for potential use of these lands for energy transportation needs would best be conducted at a local level based upon individual proposals for new or expanded projects, as is currently done by individual federal agencies as they carry out their land management responsibilities.

Most land management agencies have procedures to authorize ROWs on the lands they administer, but because of a generally fragmented ownership pattern, federal land managers seldom have the opportunity to work cooperatively or jointly with other federal agency counterparts to process an application. Local administrative offices (e.g., a national forest) may address energy transport within the boundaries of their administrative areas, and some of these local offices may have identified corridors in their land management plans as the preferred location for energy transport projects. However, there are opportunities for the agencies to collaborate and coordinate on their processes for reviewing ROW proposals as described in the following examples. For example, Agencies could implement the coordinated process developed under Section 368(a). This process includes the following:

- The federal agencies involved will select a responsible federal official to oversee the processing of the ROW applications;
- The agencies will require a single environmental review for a proposed ROW project;
- The agencies will develop a single cost-share agreement and fee schedule and seek a unified billing process for the applicant; and
- The agencies will undertake other such measures to improve the application process.

The Section 368(a) streamlining process is based on the principles of the Service First program implemented by the BLM, USFS, NPS, and USFWS. Service First was initially a joint BLM and USFS initiative designed to improve customer service by providing streamlined, one-stop shopping across agency jurisdictional boundaries for public land users.

A second example of coordination and collaboration is the MOU required by Section 1221 of EPAct and dated October 23, 2009 (USDA et al. 2009). It was signed by several federal agencies to expedite the siting and construction of qualified electric transmission infrastructure throughout the United States. Qualifying projects are defined as high-voltage transmission line projects, generally, though not necessarily, 230 kV or above and their attendant facilities; or otherwise regionally or nationally significant transmission lines and their attendant facilities, in which all or part of a proposed transmission line crosses jurisdictions administered by more than one participating agency. The purpose of the MOU is to improve coordination among project applicants, federal agencies, and states and Tribes involved in the siting and permitting process. It is expected to improve uniformity, consistency, and transparency by setting forth the roles and responsibilities of these entities when project applicants wish to construct electric transmission infrastructure. The MOU describes procedures for lead agencies, including NEPA compliance; participating agencies that are involved because a proposed project would affect land under their jurisdiction; and cooperating agencies that are involved because of their regulatory responsibilities, for example, USFWS consultation under the ESA.

Fragmented patterns of federal land jurisdiction in the East, coupled with limited opportunities for utility-scale development on many classes of federal land, make the designation of federal energy transport corridors an inefficient solution to resolving energy transmission siting challenges. Instead, coordinated, collaborative ROW application processing by federal land management agencies with current land use plans can be a more effective method to facilitate energy transmission siting. Adoption of the Service First and Section 368(a) One-Stop-Shopping procedures by the federal land management agencies in the East will be more effective than traditional agency-by-agency processing or connect-the-dots energy corridor designation in addressing the federal land needs of energy transport projects. In addition, more proactive land use planning decisions regarding anticipated ROW needs will enable federal land managers to participate efficiently with other agencies in the coordinated one-stop process.

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