4 HOW ARE CUMULATIVE IMPACTS EVALUATED?

A cumulative impact, as defined by the CEQ, "results from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). The analysis presented in this chapter places the impacts associated with West-wide energy corridor designation and land use plan amendments (the Proposed Action) into a broader context that takes into account the full range of impacts of actions taking place within the 11 western states in the foreseeable future. When viewed collectively over space and time, individual minor impacts could produce significant impacts. The goal of the cumulative impacts analysis, therefore, is to identify potentially significant impacts early in the planning process to improve decisions and move toward more sustainable development (CEQ 1997b; EPA 1999).

Sections 4.1 through 4.4 describe the methodology, regions of interest, time frame, and reasonably foreseeable future actions for the cumulative impacts assessment. Section 4.5 presents a description of the types of actions and trends occurring on federal and nonfederal lands in the 11 western states. The cumulative impacts analyses for each resource area are presented in Section 4.6. These analyses take into account the issues raised in public scoping and focus on the effects associated with the Proposed Action described in Chapter 2.

4.1 WHAT IS THE PROCESS OF ASSESSING CUMULATIVE IMPACTS?

The analysis of cumulative impacts presented in the following sections focuses on the natural resources, ecosystems, and human communities that could be affected by the incremental impacts of the alternatives described in Chapter 2. The cumulative impacts analysis builds upon the analyses of the direct and indirect impacts of the alternatives developed during preparation of this PEIS and encompasses incremental impacts to human and environmental receptors in the 11 western states.

> **Text Box 4-1**
> **What Are Cumulative Impacts?**
>
> Cumulative impacts are the incremental environmental effects of an action or actions, such as those analyzed in this PEIS, in combination with other past, present, and reasonably foreseeable future actions.

4.1.1 What Is the General Approach?

The general approach for the cumulative impacts assessment follows the principles outlined by the CEQ (1997b) and the guidance developed by the EPA (1999) for independent reviewers of environmental impact statements. The cumulative assessment presented in Section 4.6 incorporates the following basic guidelines:

- Individual receptors (or receptor groups) described in the affected environment (i.e., resource description) sections in Chapter 3 become the end points or units of analysis for the cumulative impacts analysis;
- Direct and indirect impacts described in the environmental consequences sections in Chapter 3 form the basis for the impacting factors used in the cumulative analysis;
- Impacting factors (e.g., soil disturbance) are derived from a set of past, present, and reasonably foreseeable future actions or activities; and

- The temporal and spatial boundaries of the cumulative impacts analysis are defined around the individual receptors (within each of the 11 western states) and the set of past, present, and reasonably foreseeable future actions or activities that could impact them.

In this PEIS, all of the environmental consequences for the various resource areas are discussed in Chapter 3.

4.1.2 What Is the Methodology?

The cumulative impacts analysis focuses on the human resources and environmental receptors that can be affected by the incremental impacts associated with the designation of West-wide energy corridors and land use plan amendments in combination with other past, present, and reasonably foreseeable future actions. The CEQ discusses the assessment of cumulative effects in detail in its report entitled *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997b). On the basis of the guidance provided in this report, the following methodology was developed for assessing cumulative impacts:

1. The significant cumulative impacts issues associated with the Proposed Action are identified, and the assessment goals are defined. These issues were initially identified during scoping and are discussed in Chapters 1 and 2. Other actions and issues were added later as they were identified.

2. The geographic scope (i.e., regions of influence) is defined for the analysis. The regions of influence encompass the areas of affected resources and the distances at which impacts associated with the alternatives may occur. The regions of influence are discussed in Section 4.2.

3. The time frame for the analysis is defined. The temporal aspect of the cumulative impacts analysis generally extends from the past history of impacts on each receptor through the anticipated life of the project (and beyond, for resource areas having more long-term impacts). The time frame of the actions to be evaluated in the cumulative analysis is presented in Section 4.3.

4. Past, present, and reasonably foreseeable future actions are identified. These include projects, activities, or trends that could impact human and environmental receptors within the defined regions of influence and within the defined time frame. Past and present actions are generally accounted for in the analysis of direct and indirect impacts under each resource area and carried forward to the cumulative impacts analysis. Foreseeable future actions (by type) are identified in Table 4.1-1 and described in Section 4.4.

5. The baseline conditions of resources and receptors (i.e., ecosystems and human communities) identified during scoping are characterized. Baseline characteristics are described in the affected environment sections for each resource area in Chapter 3.

6. Direct and indirect impacts to resources and receptors are characterized. Direct impacts are caused by implementing an alternative, and they occur at the same time and place as the Proposed Action. Indirect impacts are caused by the Proposed Action, but occur later in time or farther in distance from the corridors and are still reasonably foreseeable. These impacts are detailed in the environmental consequences sections of Chapter 3 for each resource area.

TABLE 4.1-1 Reasonably Foreseeable Future Actions in the 11 Western States

Types of Actions	Associated Activities and Facilities
Oil and gas exploration, development, and production	*Exploration and development:* • Exploratory drilling • Construction of well pads • Well installation • Spills/releases • Pipeline and utility corridors • Access roads and helipads • Compressor stations • Site reclamation and rehabilitation *Production:* • Production and processing plants • Refineries • Carrier pipelines • Spills/releases • Power plants • Access roads *Oil shale mining and processing:* • Surface mines • Underground mines • In situ retorting • Processing plants (rock crushing and retorting) • Refineries • Solid waste (overburden, waste rock, spent shale, and tailings) • Site reclamation and rehabilitation *Tar sands mining and processing:* • Surface mines • Underground mines • In situ recovery (e.g., steam injection) • Extraction plants • Solid waste (overburden, waste sand, spend sand, tailings) • Refineries • Site reclamation and rehabilitation
Coal and other mineral exploration, development, and production (extraction)	*Exploration and development:* • Exploratory drilling and trenching • Access roads and helipads *Production:* • Surface mines • Underground mines • Access roads • Processing (beneficiation) plants • Transportation (e.g., railroads) • Solid waste (overburden, waste rock, and tailings) • Site reclamation and rehabilitation

TABLE 4.1-1 (Cont.)

Types of Actions	Associated Activities and Facilities
Transmission and distribution systems	*Utility corridors:* • Carrier pipelines • Oil and gas pipelines • Fuel transfer stations • Spills/releases • Transmission lines • Substations • Access roads
Renewable energy development	*Wind energy:* • Vegetation clearing and excavation • Construction of meteorological towers • Construction of turbine towers • Access roads • Electrical substations and transformer pads • Ancillary facilities (e.g., control building and sanitary facilities) *Geothermal energy:* • Power plants • Well installation • Solid waste • Hydrogen sulfide recovery and recycling *Hydropower:* • Generating stations *Other technologies:* • Solar • Biomass
Commercial timber production	• Timber and vegetation harvesting • Access roads
Transportation	• Highways, roads, and parkways • Railroads (coal transport) • Hazardous material releases
Legislative actions related to land management	• See Table 4.5-8
Major land uses (federal and nonfederal)	• Forest land • Grassland pasture and rangeland • Cropland • Special uses (parks and wildlife areas) • Other uses (including commercial) • Urban land
Grazing and rangeland management	• Livestock grazing • Resource conservation (during nonuse periods) • Rangeland improvements (e.g., water pipelines, reservoirs, and fences)

TABLE 4.1-1 (Cont.)

Types of Actions	Associated Activities and Facilities
Recreation and leisure	• Visiting scenic and historic places • Cross-country and downhill skiing • Hunting and fishing • ATV use • Camping, hiking, and picnicking • Viewing wildlife • Driving for pleasure
Remediation	• Abandoned mine lands • Hazardous material sites
Population trends	• Agricultural, residential, and commercial property development adjacent to federal lands • Urbanization • Resource use (e.g., water)

7. The potential impacting factors of each past, present, or reasonably foreseeable future action or activity are determined. Impacting factors are the mechanisms by which an action affects a given resource or receptor. Both No Action and the Proposed Action would generate factors that could cause impacts to resource areas and receptors. These individual contributions are summarized in Table 4.6-1 and aggregated to form the basis of the cumulative impacts analysis to follow.

8. Cumulative impacts on receptors are evaluated by considering the impacting factors for each of the various resource areas and the incremental contribution of the Proposed Action to the cumulative impact. The cumulative impacts for each resource area are presented in Section 4.6 and are summarized in Table 4.6-2.

Cumulative impacts can be additive, less than additive, or more than additive (synergistic). In cases where the contributions of individual actions to an impacting factor were uncertain or not well known, a qualitative evaluation of cumulative impacts was necessary. A qualitative evaluation covers the locations of actions, the times they would occur, the degrees to which the impacted resource is at risk, and the potential for long-term and/or synergistic effects.

4.2 WHAT ARE THE REGIONS OF INFLUENCE?

The regions of influence encompass the geographic areas of affected resources and the distances at which impacts associated with the Proposed Action may occur. To determine which other actions should be included in a cumulative impacts analysis, the regions of influence must first be defined. These regions should not be limited to just the locations of the Proposed Action but should also take into account the distances that cumulative impacts may travel and the regional characteristics of the affected resources.

Because this PEIS addresses corridor designation and land use plan amendments at a programmatic level, the regions of influence for each resource evaluated by the cumulative impacts analysis are the 11 western states in which the corridors or corridor segments would be constructed. The geographic boundaries of areas of concern within these regions may vary based on the nature of the resource area being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than cultural resources).

4.3 WHAT IS THE TIME FRAME OF THE ACTION ALTERNATIVES?

The time frame of the cumulative impact analysis incorporates the sum of the effects of the alternatives in combination with past, present, and future actions, since impacts may accumulate or develop over time. The future actions described in this analysis are those that are "reasonably foreseeable"; that is, they are ongoing (and will continue into the future), are funded for future implementation, or are included in firm near-term plans. The reasonably foreseeable time frame for future actions evaluated in this cumulative analysis is 20 years from the designation of West-wide energy corridors and land use plan amendments. While it is difficult to project reasonably foreseeable future actions (or trends) beyond this time frame, it is acknowledged that the effects identified in the cumulative impacts analysis will likely continue beyond the 20-year horizon.

4.4 WHAT ARE THE REASONABLY FORESEEABLE FUTURE ACTIONS?

Reasonably foreseeable future actions include projects, activities, or trends that could impact human and environmental receptors within the defined regions of influence and within the defined time frame. Table 4.1-1 presents the types of future actions on federal lands that have been identified as reasonably foreseeable in the 11 western states as part of the cumulative impact analysis. Both actions that are related to West-wide energy corridor designation and actions that are unrelated to the program are described.

4.5 WHAT ARE THE TYPES OF ACTIONS?

4.5.1 Oil and Gas Exploration, Development, and Production

Oil and gas provide 62% of the energy supply in the United States and almost all of its transportation fuels (National Energy Policy Development Group 2001). In 2005, about 22% of domestic oil and 24% of domestic natural gas were produced in nine of the 11 western states (EIA 2006a).

Table 4.5-1 compares oil and gas production between 2000 and 2005 in the nine producing western states. During this period, overall production of oil in the western states decreased by almost 8% (although it increased significantly in Montana and Colorado); gas production increased by 19%. The EIA (2007a) projects continued growth and reliance on fossil fuels in the coming decades and that fossil fuels (oil, gas, and coal) will provide the same 86% share of the total U.S. primary energy supply in 2030 as they did in 2005. Future actions will focus on the development of new recovery techniques to enhance oil and gas recovery in the field (National Energy Policy Development Group 2001).

Onshore oil and gas production on federal lands make up about 5% and 11%, respectively, of domestic production (National Energy Policy Development Group 2001). In FY2004, sales of oil and gas from BLM-administered lands in the western states accounted for more than 90% of the total oil and gas sales volume from federal lands. In that year, 59,520 oil and gas wells operated on more than 18,000 leases (Table 4.5-2). The number of competitive and noncompetitive oil and gas leases declined slightly from FY2000 to FY2004, after peaking in FY2002 and FY2003 (BLM 2005i).

A recent interagency study of the oil and gas resources on federal lands focused on

TABLE 4.5-1 Oil and Gas Production in the Western Region in 2000 and 2005

State	Oil Production (bbl)[a] 2000	Oil Production (bbl)[a] 2005	Oil Production (bbl)[a] Percent Change	Gas Production (mcf)[a] 2000	Gas Production (mcf)[a] 2005	Gas Production (mcf)[a] Percent Change
Arizona	59,000	50,000	–15.3	368	233	–36.7
California	271,132,000	230,294,000	–15.1	418,865	352,044	–16.0
Colorado	18,481,000	22,823,000	23.5	760,213	1,143,985	50.5
Montana	15,428,000	32,855,000	113.0	70,424	108,555	54.1
Nevada	621,000	447,000	–28.0	7	5	–28.6
New Mexico	67,198,000	60,660,000	–9.7	1,820,516	1,656,850	–9.0
Oregon	0	0	0	1,412	454	–67.8
Utah	15,636,000	16,651,000	6.5	281,117	311,994	11.0
Wyoming	60,726,000	51,626,000	–15.0	1,326,042	2,003,826	51.1
Total	449,281,000	415,406,000	–7.5	4,678,964	5,577,946	19.2

[a] bbl = barrels and mcf = million cubic feet.

Sources: EIA (2001, 2006c, 2007b).

TABLE 4.5-2 Oil and Gas Activities on BLM-Administered Public Lands in FY2004

State	Producible and Service Holes	Producible Leases	Acres in Producing Status	Oil Sales Volume (bbl)[a]	Gas Sales Volume (mcf)[a]
Arizona	1	0	0	–[b]	–
California	5,887	304	70,339	15,827,500	6,733,922
Colorado	3,573	2,039	1,340,546	3,998,996	111,355,670
Idaho	–	–	–	–	–
Montana	2,156	1,360	736,958	3,434,518	21,371,718
Nevada	102	29	15,498	598,796	–
New Mexico	25,112	6,598	3,769,487	30,336,794	930,158,803
Oregon	–	–	–	–	
Utah	3,745	1,235	916,106	4,121,756	126,362,710
Washington	1	0	0	–	–
Wyoming	18,943	7,263	3,719,919	33,345,702	911,199,107
Total	59,520	18,828	10,568,853	91,664,062	2,107,181,930

[a] bbl = barrels and mcf = million cubic feet.

[b] – = no activity.

Source: BLM (2005i).

five geologic basins in the western states: Paradox/San Juan Basin, Uinta/Piceance Basin, Greater Green River Basin, Powder River Basin, and the Montana Thrust Belt. The study found that as much as 68% of undiscovered U.S. oil resources and 74% of undiscovered natural gas resources (including coalbed methane) are present within federal lands (DOI 2003, 2005c). The potential for the future expansion in oil and gas exploration, development, and production on federal lands is high.

Oil shale is a sedimentary rock that releases petroleum-like liquid when heated. The mining and processing of oil shale is more complex and expensive than conventional oil recovery; however, increasing oil prices and advances in technology are making it a more feasible energy option. It is estimated that about 72% of the U.S. acreage containing oil shale deposits occurs under federal land in the Green River Formation, a geologic unit that underlies portions of Colorado, Utah, and Wyoming (Figure 2.2-4f). The oil shale in the Green River Formation has the potential to yield as much as 1.5 trillion barrels of oil (BLM 2005i). While there are currently no federal oil shale leases, the likelihood of future leases is high. The BLM is currently preparing a PEIS for oil shale leasing in these three states (BLM 2006j).

Tar sand deposits comprise another oil-yielding resource under western federal land, primarily in eastern Utah (Figure 2.2-4f). These deposits are a combination of clay, sand, water, and bitumen that can be mined and processed to produce oil. It is estimated that these deposits could yield as much as 76 billion barrels of oil (BLM 2005i). While there are currently no federal tar sand leases, the likelihood of future leases is high. The BLM is currently preparing a PEIS for tar sands leasing (together with oil shale leasing) in Colorado, Utah, and Wyoming (BLM 2006j).

4.5.2 Coal and Other Mineral Exploration, Development, and Production

Coal accounts for more than half of the electricity generation in the United States. The electric power sector is the largest coal consumer, accounting for the largest increase (2.1%) in coal consumption relative to other sectors (industrial, commercial, and residential) in 2005 (EIA 2006b).

Coal production in the West reached a record level in 2005, with a total of 553.6 million short tons being produced in seven of the 11 western states, about half of the total U.S. coal production (1,131.5 million short tons) in 2005 (EIA 2006b). Wyoming is the biggest producer of coal in the United States, with a total of 404.3 million short tons of coal produced in 2005 (Figure 2.2-4f).

Table 4.5-3 compares coal production between 2000 and 2005 in the seven producing western states. During this period, overall production increased by almost 14%, continuing a trend of steady increases since the 1970s. The EIA (2007) projects continued growth through 2030 with an average of 1.1% per year from 2005 to 2015 and 1.8% per year from 2015 to 2030. Most of the projected growth is attributed to increased output of surface mines in the Powder River Basin in Wyoming. Demand for low-sulfur western coal is expected to increase because of its environmental benefits relative to other coal sources (National Energy Development Policy Group 2001).

About 38% of the coal produced in the United States comes from federal and Tribal lands in the western states (BLM 2006i).

Economic production of mineral resources on BLM-administered land includes locatable, leasable, and salable solid minerals. Locatable minerals, defined under the General Mining Law of 1972, can be obtained by locating a mining claim; they include both metallic and

TABLE 4.5-3 Coal Production in the Western Region in 2000 and 2005

State	2000 (million short tons)	2005 (million short tons)	Percent Change from 2000 to 2005
Arizona	13.1	12.1	–8.3
Colorado	29.1	38.5	24.4
Montana	38.4	40.4	5.0
New Mexico	27.3	28.5	4.2
Utah	26.7	24.5	–9.0
Washington	4.2	5.3	20.8
Wyoming	338.9	404.3	16.2
Total	477.7	553.6	13.7

Sources: EIA (2006b, 2007c).

nonmetallic materials. Locatable minerals mined on BLM land include gold, silver, lead, and uranium. By the end of FY2005, there were 200,838 active mining claims on file with the BLM, with the highest number (73,418) in Nevada (BLM 2006h). This represents a 12% decline from FY2000 in which 227,431 mining claims (105,555 in Nevada) were on file (BLM 2001a). In FY2002, about 1,000 development holes were drilled for uranium on BLM land (BLM 2005i).

Leasable minerals are subject to the Mining Leasing Act of 1920 and include energy and nonenergy resources; leases to these resources are obtained through a competitive bidding process. Leasable minerals mined on BLM land include coal, sodium, potassium, phosphate, gilsonite, and uranium. The number of leases and associated acres for coal, sodium, potassium, phosphate, and gilsonite on BLM-administered land in FY2000 and FY2005 are shown in Table 4.5-4. The number of coal leases and associated acres have decreased slightly in Colorado, New Mexico, and Utah since 2000, but have increased in Wyoming. The number of leases and associated acres for sodium mining have also decreased since 2000; potassium and phosphate leases have remained steady, although the acres associated with their mining have increased. The number of leases and associated acres for gilsonite mining have remained steady (gilsonite is a natural, resinous hydrocarbon that is similar to a hard petroleum asphalt).

Salable minerals include basic natural resources such as sand and gravel that the BLM sells to the public at fair market value. Other salable materials include soil, stone, clay, and pumice. In FY2005, about 19.5 million cubic yards of mineral materials were disposed of through exclusive and nonexclusive sales and free use permits, representing an increase of 7.5 million cubic yards over FY2000 (BLM 2006h).

The FS reports an estimated 50 billion tons of coal under its NFS lands, with the largest reserves in Colorado and Utah. In 2002, the agency's mineral activities included 150,000 mining claims; 3,000 bonded operations; and 9,000 sales contracts and leases. Other minerals with high development potential on NFS lands include uranium, phosphate, lead, gold, silver, platinum-paladium, and sand and gravel (Schuster and Krebs 2003).

4.5.3 Transmission and Distribution Systems

About 90% of the oil and gas pipeline and electricity transmission ROWs in the western

TABLE 4.5-4 Solid Mineral Leases on BLM Public Lands in FY2000 and FY2005

Leasable Mineral Resource	Number of Leases		Acres	
	2000	2005	2000	2005
Coal				
Colorado	62	53	81,873	79,050
Montana	28	28	43,901	34,635
New Mexico	12	11	27,232	25,272
Utah	93	84	112,355	106,514
Washington	2	2	521	521
Wyoming	81	84	153,755	174,746
Total	278	262	419,637	420,738
Sodium				
Arizona	1	0	4	0
California	34	13	25,826	21,334
Colorado	8	8	16,675	16,674
Nevada	15	0	36,953	0
New Mexico	4	4	2,000	2,000
Utah	8	0	15,366	0
Wyoming	66	63	84,366	77,739
Total	136	88	181,190	117,747
Potassium				
California	8	6	10,286	10,286
Nevada	0	1	0	2,320
New Mexico	108	112	129,115	135,035
Utah	22	18	35,412	34,612
Total	138	137	174,813	182,253
Phosphate				
Idaho	1	1	1,409	1,409
Montana	84	86	39,715	43,755
Utah	7	7	13,029	13,029
Total	92	94	54,153	58,193
Gilsonite				
Utah	13	13	3,641	3,640

Sources: BLM (2001a, 2006h).

states cross public lands (National Energy Policy Development Group 2001). In FY2005, the BLM had a total of 88,729 existing ROWs for oil and gas pipelines and electricity transmission lines in the 11 western states (BLM 2006h). This represents a 6% increase over the number of ROWs (83,249) in existence in FY2000. The largest increase in ROWs granted between FY2000 and FY2005 occurred in Wyoming (up 23.2%), New Mexico (up 12.7%), Nevada (up 9.7%), and Utah (up 9.7%) (Table 4.5-5). BLM processed 2,727 ROW applications and granted or amended 3,775 ROWs in FY2005 (BLM 2006h).

TABLE 4.5-5 Number of Existing ROWs on BLM Public Lands in FY2000 and FY2005

State	Total ROWs in 2000	Total ROWs in 2005			% Change from 2000 to 2005
		MLA[a]	FLPMA[a]	Total	
Arizona	4,760	283	4,242	4,525	–4.9
California	6,180	243	5,548	5,791	–6.3
Colorado	6,297	1,211	4,966	6,177	–1.9
Idaho	5,128	112	4,571	4,683	–8.7
Montanaa	4,387	322	3,263	3,585	–18.3
Nevada	6,845	116	7,395	7,511	9.7
New Mexico	23,259	17,960	8,260	26,220	12.7
Oregon[b]	8,919	22	9,320	9,342	4.7
Utah	4,668	847	4,273	5,120	9.7
Wyoming	12,806	6,098	9,677	15,775	23.2
Total	83,249	26,021	61,515	88,729	6.6

[a] MLA = Mineral Leasing Act of 1920; FLPMA = Federal Land Policy and Management Act of 1976.

[b] Authorized use is tallied by the administrative state. The Montana number includes ROWs on BLM-administered land in North Dakota and South Dakota, and Washington is included in the tally for Oregon.

Sources: BLM (2001a, 2005i).

The National Energy Policy Development Group (2001) projects that the demand for additional energy and electricity will increase the number of ROWs across public lands in the years to come. Other federal agencies authorized to grant ROWs for electric, oil, and gas transmission include the FS, the NPS (electric only), the USFWS, the BOR, and the BIA.

4.5.4 Renewable Energy Development

4.5.4.1 Wind Energy

Wind energy is derived from the naturally occurring energy of the wind. It accounts for about 6% of the renewable electricity generation and 0.1% of the total U.S. electrical supply (National Energy Policy Development Group 2001). Most of the wind energy potential in the United States is in the western states (Figure 2.2-2a). Currently about 20% of the installed wind energy capacity is generated on federal lands, and the potential for future development on federal lands in the western states is high (BLM 2005i). For example, the BLM (2005i) estimates that as many as 10 million acres (46%) of federal land in Nevada have the potential for wind energy development.

4.5.4.2 Geothermal Energy

Geothermal energy resources are the steam and hot water generated by heat from within the Earth. They account for about 17% of the renewable electricity generation and 0.3% of the total U.S. electricity supply (National Energy Policy Development Group 2001). Most of the U.S. production of geothermal energy occurs in the western states (and also Alaska and Hawaii), with as much as 50% on federal land (BLM 2006i). California and Nevada are currently the highest-producing states (Table 4.5-6; Figure 2.2-4b). The number of leases granted by BLM increased by about 22% between FY2000 and FY2005. The number of acres in use for geothermal development also increased during this period.

4.5.4.3 Hydropower

Hydropower generation accounts for about 7% of the total U.S. electricity supply (National Energy Policy Development Group 2001). Five of the western states depend heavily on this resource: California, Idaho, Montana, Oregon, and Washington. Since the areas best suited for this technology have already been developed, it is likely that future development of this technology will be relatively low. Generating capacity in the future will be affected most by activities at existing facilities (e.g., adding turbines or increasing efficiency) or by droughts (which can reduce generating capacity) (BLM 2006i).

4.5.4.4 Other Technologies

Other renewable energy sources with potential for increased development in the West include solar energy and biomass (organic matter). Solar energy accounts for about 1% of renewable electricity generation and about 0.02% of the total U.S. electricity supply (National Energy Policy Development Group 2001). The potential for solar energy development in the 11 western states is shown in Figure 2.2-4c. Currently, there are applications pending for commercial solar power generating facilities on BLM public lands in Imperial and San Bernardino counties in southern California.

Biomass resources account for about 76% of renewable electricity generation and about 1.6% of the total U.S. electricity supply (National Energy Policy Development Group 2001). It is

TABLE 4.5-6 Competitive and Noncompetitive Geothermal Leases on BLM Public Lands in FY2005

State	Acres in Use	Leases	Producing Wells[a]	Total Electrical Generation (GW-hour)[a]
Arizona	2,084	1[b]	NA[c]	NA
California	90,397	67	273	4,109
Idaho	2,465	3[b]	NA	NA
Nevada	322,239	213	45	1,120
New Mexico	4,581	4	1	0
Oregon	54,151	57	4	217
Utah	8,047	9	0	0

[a] The number of producing wells and total electrical generation are from BLM (2005j) for fiscal year 2004.

[b] Number represents noncompetitive lease(s).

[c] NA = not available.

Sources: BLM (2005i, 2006h).

estimated that restoration activities on as many as 12 million acres of public land administered by the BLM would remove biomass that could be used as an energy source. The FS is currently soliciting proposals to increase the use of woody biomass from the NFS by creating markets for small-diameter vegetation and low-valued trees removed during forest restoration activities (*Federal Register* 2006).

4.5.5 Commercial Timber Production

About 33% of the land in the United States is forest land (749 million acres); of this, about one-third (246 million acres) is owned by the federal government. The remainder is classified as nonfederal forest land (406 million acres) and forest land in parks and other special use areas (98 million acres) (Lubowski et al. 2006). The FS defines forest land as “land at least 10-percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially reforested.” Timberland is a class of forest land that is capable of commercial timber production and not removed from timber use by statute or administrative regulation (Alig et al. 2003).

As of 2002, about 30% of U.S. forest land (231 million acres) was located in the 11 western states (Table 4.5-7). States with the greatest forest land acreage include California (40.2 million acres), Oregon (29.7 million acres), and Montana (23.3 million acres). About 54% (125 million acres) of forest land in the West is classified as timberland, of which about 76.8 million acres are federally owned. Timberland makes up the highest percentage of forest land in Montana (82%), Oregon (80%), Washington (80%), and Idaho (78%).

The USDA reports that in recent decades, U.S. timberland acreage has had an upward trend, gaining 19 million acres between 1987 and 1997 and stabilizing at 504 million acres between 1997 and 2002. These increases were due in part to reclassification in response to rising prices for forest products (Lubowski et al. 2006). Forecasts of forest land acreage in the

TABLE 4.5-7 Forest Land in the 11 Western States by Major Class, FY2002 (in 1,000 acres)

	Total Forest Land			Timberland			Reserved
State	Federal	Nonfederal	Total[a]	Federal	Nonfederal	Total[a]	Timberland and Other Forest Land[b]
Arizona	10,192	9,235	19,427	2,438	1,089	3,527	15,901
California	22,371	17,862	40,233	10,130	7,651	17,781	22,451
Colorado	15,075	6,562	21,637	8,020	3,587	11,607	10,030
Idaho	17,129	4,517	21,646	12,596	4,227	16,824	4,823
Montana	16,512	6,781	23,293	12,506	6,679	19,184	4,108
Nevada	9,608	596	10,204	265	99	363	9,841
New Mexico	9,522	7,159	16,682	2,829	1,530	4,359	12,323
Oregon	17,741	11,910	29,651	14,194	9,637	23,831	5,819
Utah	11,913	3,764	15,676	3,586	1,097	4,683	10,994
Washington	9,422	12,369	21,790	6,104	11,244	17,347	4,443
Wyoming	8,832	2,163	10,995	4,093	1,647	5,739	5,256
Total	148,317	82,918	231,234	76,761	48,487	125,245	105,989

[a] Distributions may not add to totals due to rounding.

[b] Includes forest land in parks, wildlife areas, and other special use areas.

Source: ERS (2007).

West over the next 40 years show a slight decline (about 3% relative to 2002), although total public forest land acreage is not expected to change. The total area of timberland in the West (including public, forest industry, and nonindustrial private land) is also projected to decline by about 3% by 2050 (Alig et al. 2003).

Major timber products include roundwood, lumber (softwood and hardwood), plywood, turpentine, rosin, pulpwood, and paperboard. Production levels for these products rose steadily between 1965 and 1988, then experienced declines until the mid-1990s. Since the mid-1990s, roundwood production has fallen slightly. Lumber production has been increasing but, as of fiscal year 2002, remains below the record levels of the late 1980s. The USDA reported a record in per capita consumption of lumber in the United States in 2002, which was below the high set in 1999 but greater than per capita consumption levels in the 1960s, 1970s, and early 1980s. About 40% of the lumber consumed was used for housing. Other uses include manufacturing at 13%; nonresidential construction (e.g., railroads) at 8%; and shipping (pallets, containers, and dunnage) at 11% (Howard 2003).

The potential for continued growth in the wood products markets will follow the trends in new housing construction and residential improvements. Demand by the furniture and fixtures industry, another major market for hardwood lumber, plywood, veneer, and particleboard, is on the decline, falling 11% in 2002 because of continued growth in furniture imports from China (Howard 2003).

4.5.6 Transportation

4.5.6.1 Federal Lands Highway Program

The Federal Lands Highway Program is administered by the Federal Lands Highway Division of the Federal Highway Administration (FHWA) within the U.S. Department of Transportation. The program provides funding and engineering services for the planning, design, construction, and rehabilitation of forest highway system roads, bridges and tunnels, park roads and parkways, Indian reservation roads, defense access roads, other federal lands roads, and public authority-owned roads serving federal lands (FHWA 2007). A recent Transportation Research Board task force report cites the important relationship between transportation and visitation levels on federal lands. As tourism-related visits (and traffic) rise, access and user demands are exceeding the system's carrying capacity. Current interagency initiatives are focusing on meeting these demands (Eck and Wilson 2000).

4.5.6.2 Transportation of Coal by Rail

Coal is an important commodity transported by rail. Over the past decade, coal's share of rail traffic has increased mainly because of the increased production in the western states of low-sulfur coal, which is transported long distances over rail. In 2000, an average of 14.4 million tons of coal were transported along domestic railroads each week. The demand for clean coal (i.e., low sulfur coal) is expected to increase in the coming decades. This increase in demand could result in capacity shortfalls and delays in transportation, since the current rail system has little excess capacity (National Energy Policy Development Group 2001). Currently, two rail expansion projects have been proposed for the Powder River Basin of Wyoming to meet this increased demand. These include the Dakota, Minnesota, & Eastern Railroad Powder River Basin Expansion Project and the Burlington Northern and Santa Fe Railway Company's expansion projects (to four tracks).

4.5.7 Legislative Acts Related to Land Management

Major statutes governing the management of federal lands are listed in Table 4.5-8.

TABLE 4.5-8 Major Statutes Governing Land Management Activities on Federal Lands in the 11 Western States

Federal Agency	Major Statute	Citation
Bureau of Land Management	Federal Coal Leasing Amendments Act of 1976	P.L. 94–377, 90 Stat. 1083–1092
	Federal Land Exchange Facilitation Act of 1988	P.L. 100–409, 102 Stat. 1086 43 USC 1716
	Federal Land Policy and Management Act of 1976	P.L. 94–579, 90 Stat. 2744 43 USC 2301
	Federal Land Transaction Facilitation Act of 2000	P.L. 106–248, 114 Stat. 613 43 USC 2301 et seq.
	General Mining Law of 1872	Ch. 152, 17 Stat. 91 30 USC 22 et seq.
	Materials Act of 1947	Ch. 406, 61 Stat. 681 30 USC 601 et seq.
	Mineral Leasing Act for Acquired Lands (1947)	Ch. 513, 61 Stat. 913 30 USC 351–359
	Mineral Leasing Act of 1920	Ch. 85, 41 Stat. 437 30 USC 181 et seq.
	Public Rangelands Improvement Act of 1978	P.L. 95–514, 92 Stat. 1803 43 USC 1901 et seq.
	South Nevada Public Land Management Act of 1988	P.L. 105–263, 112 Stat. 2343 31 USC 6901 note
	Taylor Grazing Act of 1934	Ch. 865, 48 Stat. 1269 43 USC 315 et seq.
	Wild Free-Roaming Horses and Burros Act of 1971	P.L. 92–195, 85 Stat. 649 16 USC 1331 et seq.
Forest Service	Cooperative Forestry Assistance Act of 1978	P.L. 95–313, as amended, 92 Stat. 365 16 USC 2101 et seq.
	Forest and Rangeland Renewable Resources Planning Act of 1974	P.L. 93–378, 88 Stat. 476 16 USC 1600 et seq.
	Forest and Rangeland Renewable Resources Research Act of 1978	P.L. 95–307, 92 Stat. 353 16 USC 1641 et seq.
	Multiple-Use Sustained-Yield Act of 1960	P.L. 86–517, 75 Stat. 215 16 USC 528 et seq.
	National Forest Management Act of 1976	P.L. 94–588, 90 Stat. 2949 16 USC 1601 et al.

TABLE 4.5-8 (Cont.)

Federal Agency	Major Statute	Citation
Forest Service (Cont.)	Organic Administration Act of 1897	Ch. 2, 30 Stat. 11 16 USC 473 et seq.
	Pickett Act (1910)	CH. 421, 36 Stat. 847
	Weeks Law of 1911	Ch. 186, 36 Stat. 961 16 USC 515 et al.
National Park Service	Mining in National Parks (1976)	P.L. 94–429, 90 Stat. 1342 16 USC 1901–1912
	National Park Service General Authorities Act of 1970	P.L. 91–383, 84 Stat. 825 16 USC 1a–1, 1c
	National Park Service Organic Act of 1916	Ch. 408, 39 Stat. 535 16 USC 1–4
	National Parks Omnibus Management Act of 1998	P.L. 105–391, 112 Stat. 3497 16 USC 5901 et seq.
	Omnibus Parks and Public Lands Management Act of 1996	P.L. 104–333, 110 Stat. 4093 16 USC 1 et seq.
	Preservation of American Antiquities (1906)	Ch. 3060, 34 Stat. 225 16 USC 431–433
	Recreational Fee Demonstration Program: § 315 of the Interior and Related Agencies Appropriations Act, 1996; § 101(c) of the Omnibus Consolidated Rescissions and Appropriations Act, 1996	P.L. 104–134, 110 Stat. 1321–2000 16 USC 460l
	Yellowstone National Park Act (1872)	Ch. 24, 17 Stat. 32 16 USC 21 et seq.
Fish and Wildlife Service	Endangered Species Act of 1973	P.L. 93–205, 87 Stat. 884 16 USC 1531–1544
	Fish and Wildlife Act of 1956	Ch. 1036, 70 Stat. 1120 16 USC 742a et seq.
	Migratory Bird Treaty Act of 1918	Ch. 128, 40 Stat. 755 16 USC 703–712
	Fish and Wildlife Coordination Act of 1934	Ch. 55, 48 Stat. 401 16 USC 661–667e

TABLE 4.5-8 (Cont.)

Federal Agency	Major Statute	Citation
Fish and Wildlife Service (Cont.)	National Wildlife Refuge System Administration Act of 1966	P.L. 90–404, 80 Stat. 927 16 USC 668dd–668ee
	National Wildlife Refuge System Improvement Act of 1997	P.L. 105–57 16 USC 668dd
	San Francisco Bay National Wildlife Refuge (1972)	P.L. 92–330, 86 Stat. 399 16 USC 668dd note
National Wilderness Preservation System, National Wild and Scenic Rivers System, and National Trails System (multiagency)	California Desert Protection Act of 1994	P.O. 103–433, 108 Stat. 4471
	National Parks and Recreation Act of 1978	P.L. 95–625, 92 Stat. 3467
	National Trails System Act (1965)	P.L. 90–543, 82 Stat. 919 16 USC 1241 et seq.
	Outdoor Recreation Act of 1963	P.L. 88–29 16 USC 4601
	Wild and Scenic Rivers Act (1968)	P.L. 90–542, 82 Stat. 906 16 USC 1271 et seq.
	Wilderness Act (1964)	P.L. 88–577, 78 Stat. 890 16 USC 1131 et seq.
Other	Energy Policy Act of 2005	P.L. 109–58, 42 USC 15801
	Federal Power Act (1920)	Ch. 285, 41 Stat. 1063 16 USC 791–828c
	National Energy Policy and Conservation Act (2000)	P.L. 106–469 42 USC 6201
	National Environmental Policy Act of 1969	42 USC 4321–4347

Source: Vincent et al. (2001).

4.5.8 Major Uses of Federal and Nonfederal Land

In 2002, the major uses of federal and nonfederal land in the United States were forest-use land, grassland pasture and rangeland, cropland, special uses (parks and wildlife areas), miscellaneous other uses, and urban land.[1] Table 4.5-9 compares the major land uses for the 11 western states in 1997 and 2002. Most of the land (47%) in the 11 western states is used as grassland pasture and rangeland. Although total grazing land acreage in the United States has been on the decline since the 1940s, it remained fairly stable in the 11 western states between 1997 and 2002. Forest-use land increased by 5.9 million acres (about 3%) in the 11 western states during the same 5 years. Population has increased between 1990 and 2000 (Section 4.5.12); however, the total acreage devoted to urban land use decreased between 1997 and 2002. Land under the special-use category increased by 5.3 million acres (about 6%) between 1997 and 2002; this was most likely the result of improved data, which led to the reclassification of land in the miscellaneous other-use category (Lubowski et al. 2006).

4.5.9 Grazing and Rangeland Management

In FY2002, grazing land comprised about 60% of the land area in the 11 western states. Grazing takes place on lands the Economic Research Service (ERS) categorizes as cropland pasture, grassland pasture and range, and forest land-grazed (Table 4.5-10). Cropland pasture is the smallest, but generally the most productive component of grazing acreage, accounting for only 1% of the land area in the 11 western states. Grassland pasture and range occupies almost half of the land area in the 11 western states. Grazing is also high on forest land in the West, accounting for about 12% of land area in the 11 western states. New Mexico, Wyoming, and Nevada have the greatest percentage of grazing land. Almost all of BLM lands, as well as the majority of the acreage of the NFS, are available for grazing by private livestock ranchers.

The total grazing land in the United States has declined by about 25% since 1945, due mainly to changes in land use to recreational, wildlife, and environmental uses (with some acres converted to urban uses). Other reasons cited by Lubowski et al. (2006) include fewer farms and less land in farms, increases in forest stand density (making grazing more difficult), and changes in livestock feeding practices.

In FY2005, there were 17,374 permits and leases for livestock grazing, with a total of about 12.6 million active animal unit months (AUMs) on BLM-administered land in the 11 western states. Of those, about 6.8 million AUMs (54%) were authorized and in use (BLM 2006h). About 90% of the authorizations were for the grazing of cattle, 9.5% for sheep and goats, and less than 1% for horses and burros. The nonuse AUMs are generally attributed to drought and financial conditions (BLM 2004f). Table 4.5-11 shows the number of permits and leases and AUMs by state for BLM-administered rangeland. The FS authorizes about 8 million AUMs annually (Schuster and Krebs 2003).

Since 1996, there has been a general downward trend in the number of permits and leases and active use of federal lands for grazing. This trend continues a decades-long trend for public land livestock operators and for the livestock industry as a whole as it consolidates into fewer but larger operations. Studies have shown, however, that federal rangelands administered by the BLM and the FS will continue to be an important part of the livestock-raising subsector of the agriculture industry (BLM 2004f).

A study conducted by Van Tassell et al. (2001) for the FS projected a downward trend in the future livestock grazing demands on federal lands, with the greatest decline in AUMs occurring on land administered by the FS. The

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1 The major use categories discussed in this section are defined in the footnotes of Table 4.5-9, based on Lubowski et al. (2006).

TABLE 4.5-9 Major Uses of Land by State in 1997 and 2002 (in 1,000 acres)[a]

State	Cropland[b] 1997	Cropland[b] 2002	Grassland and Pasture and Range[c] 1997	Grassland and Pasture and Range[c] 2002	Forest Use Land[d] 1997	Forest Use Land[d] 2002	Special Uses[e] 1997	Special Uses[e] 2002	Urban Land 1997	Urban Land 2002	Other Use Land[f] 1997	Other Use Land[f] 2002
Arizona	1,254	1,235	40,509	40,533	16,306	17,608	10,092	11,373	1,746	1,080	4,571	897
California	10,628	10,655	22,343	21,729	32,579	33,780	20,996	21,558	5,922	5,095	13,277	6,997
Colorado	11,415	12,044	27,867	28,158	18,781	18,925	5,699	6,022	1,070	814	2,623	417
Idaho	5,766	6,408	21,165	20,984	17,123	16,824	5,266	6,175	233	263	3,641	2,305
Montana	18,573	18,118	46,039	46,361	19,165	19,184	6,414	6,863	196	168	2,965	2,458
Nevada	867	884	46,273	46,448	8,199	8,636	5,726	6,882	801	350	9,204	7,088
New Mexico	2,427	2,671	52,188	51,676	14,084	14,978	6,360	6,449	636	484	2,615	1,410
Oregon	5,338	5,311	22,395	23,239	26,664	27,169	3,593	3,946	610	662	3,450	1,112
Utah	2,045	2,044	23,737	24,339	13,832	14,905	5,058	4,958	549	444	7,916	5,882
Washington	8,400	7,983	7,406	7,369	17,418	17,347	6,639	6,839	1,371	1,367	2,749	1,682
Wyoming	3,080	2,860	44,873	44,323	5,085	5,739	6,332	6,416	206	109	2,777	2,697
Total	69,793	70,213	354,800	355,159	189,236	195,095	82,175	87,481	13,340	10,836	55,788	32,945

[a] Includes both federal and nonfederal lands.

[b] Total acreage in the crop rotation.

[c] Grassland and other nonforested pasture and range in farms, excluding cropland used only for pasture, plus estimates of open or nonforested grazing land not in farms.

[d] Forest-use land includes both grazed and ungrazed forest but excludes an estimated 98 million acres in parks, wildlife areas, and other special uses of land.

[e] Special uses include transportation, parks, wildlife areas, defense and industrial areas, farmsteads (and farm roads and lanes).

[f] Other uses category refers to areas in miscellaneous uses not inventoried and marshes, open swamps, bare rock areas, desert, tundra, and other land generally of low value for agricultural purposes.

Sources: Lubowski et al. (2006); ERS (2007).

TABLE 4.5-10 Grazing Land in the 11 Western States, 2002 (in 1,000 acres)[a]

State	Cropland Pasture	Grassland Pasture and Range	Forest Land Grazed	Total Grazing Land	Percent of Land Area
Arizona	214	40,533	11,709	52,456	72.2
California	1,345	21,729	12,070	35,144	35.1
Colorado	1,835	28,158	10,516	40,509	60.9
Idaho	770	20,984	4,432	26,186	49.5
Montana	1,726	46,361	6,620	54,707	58.7
Nevada	314	46,448	6,887	53,649	76.4
New Mexico	837	51,676	9,482	61,995	79.7
Oregon	1,003	23,239	11,558	35,800	58.1
Utah	602	24,339	9,596	34,537	65.5
Washington	499	7,369	3,879	11,747	27.5
Wyoming	913	44,323	3,543	48,779	78.2
Total	10,058	355,159	90,292	455,509	60.5

[a] Includes both federal and nonfederal land.

Source: ERS (2007).

study attributed the declines mainly to urban sprawl and the increase in suburbanization (e.g., ranchette development). Other causes cited were increased demand for recreation, building of second homes in rural areas, and reforestation projects. Wildlife utilization of grazing lands (especially nonconsumptive utilization) is expected to increase into the future.

4.5.10 Recreation

Table 4.5-12 lists the number of recreation visits for the BLM, FS, and NPS in FY2000 and FY2005. By far, the NFS experienced the greatest number of visits (over 135 million). Visits to BLM lands increased in the 11 western states by 5.5 million (about 11%), with the greatest increases occurring in Montana, Nevada, and Colorado. Declines in visits were also recorded, most notably in Wyoming, Oregon, and Idaho. Visits to FS sites decreased by about 7.5 million (about 5%) in five of the six states for which data were available (California, Colorado, Idaho, Montana, and Washington). Visits to NPS sites decreased in the 11 western states by 4.1 million (about 5%) between FY2000 and FY2005. The greatest declines occurred in Nevada, Utah, and Colorado.

The fastest-growing outdoor recreation activities through 2050 (as measured by the number of participants) are projected to be cross-country skiing (95% growth); downhill skiing (93% growth); visiting historic places (76% growth); sightseeing (71% growth); and biking (70% growth). By activity days, increases through 2050 are projected to be visiting historic places (116% growth); downhill skiing (110% growth); snowmobiling (99% growth); sightseeing (98% growth); and nonconsumptive wildlife activity (97% growth) (Bowker et al. 1999). Public lands offer opportunities for these activities; for example, most downhill skiing capacity is located in the western states, especially on national forest lands (Cordell et al. 1990). Therefore, the potential for increased tourism and recreational use of public lands over the next 20 years is considered high.

TABLE 4.5-11 Grazing Permits and Leases on BLM Public Lands as of FY2005

State	Permits or Leases	Active AUMs[a]	Authorized AUMs[b]
Arizona	758	660,528	376,752
California	555	361,430	120,987
Colorado	1,594	664,003	279,480
Idaho	1,889	1,351,806	811,145
Montana	3,743	1,283,126	891,671
Nevada	662	2,187,729	937,965
New Mexico	2,286	1,861,231	1,093,869
Oregon	1,284	1,026,548	604,873
Utah	1,519	1,238,877	620,030
Washington	294	32,144	–[b]
Wyoming	2,790	1,949,749	1,061,827
Total:	17,374	12,617,171	6,798,599

[a] An AUM (animal unit month) is the amount of forage needed by an “animal unit” (i.e., a mature 1,000-lb cow and her calf) for one month. The active AUMs reported are the total number that could be authorized on BLM public lands.

[b] Authorized use is tallied by administrative state. The Montana number includes AUMs authorized on BLM-administered land in North Dakota and South Dakota; and Washington is included in the tally for Oregon.

Source: BLM (2006h).

4.5.11 Remediation

The EPA uses the National Priorities List (NPL) as an informational tool to identify sites that may present a significant risk to public health and/or the environment. Sites included on the NPL undergo an initial assessment to determine whether further investigation to characterize the nature and extent of the public health and environmental risks associated with the site is necessary, and to determine what response action, if any, may be warranted. Inclusion of a site on the NPL does not necessarily mean that the EPA will require a response action. The numbers of sites on the NPL that occur in each of the 11 western states are as follows (numbers in parentheses indicate additional sites that have been deleted from the NPL): Arizona, 8 (3); California, 93 with an additional 3 proposed (11); Colorado, 17 with an additional 2 proposed (3); Idaho, 6 with an additional 3 proposed (3); Montana, 14 with an additional 1 proposed (0); Nevada, 1 (0); New Mexico, 12 with an additional 2 proposed (4); Oregon, 11 with an additional 1 proposed (4); Utah, 14 with an additional 5 proposed (4); Washington, 48 (17); and Wyoming, 2 (1). Additional information on these sites, including site name, description, threats/contaminants, and cleanup status, can be found at EPA (2007).

As of the end of FY2005, the BLM reports a total of 3,586 sites on its public lands in the 11 western states that have had releases of

TABLE 4.5-12 Recreation Visits for the BLM, FS, and NPS in FY2000 and FY2005

	Visits to BLM Lands			Visits to FS Lands			Visits to NPS Lands[a]		
State	2000	2005	% Change	2000	2005	% Change	2000	2005	% Change
Arizona	4,997,000	5,557,000	11.2	13,859,000	14,309,000	3.2	11,525,818	10,799,429	–6.3
California	8,400,000	9,604,000	14.3	32,403,000	29,786,000	–8.1	34,410,505	33,400,604	–2.9
Colorado	4,756,000	5,746,000	20.8	27,948,000	25,728,000	–7.9	5,807,033	5,352,839	–7.8
Idaho	6,326,000	5,870,000	–7.2	7,907,000	7,043,000	–10.9	437,473	446,507	2.1
Montana	3,136,000	4,093,000	30.5	9,151,000	8,657,000	–5.4	3,696,401	3,877,478	4.9
Nevada	5,045,000	6,183,000	22.6	–[b]	7,188,000	–[b]	6,647,299	5,847,070	–12.0
New Mexico	2,380,000	2,384,000	<1.0	–[b]	2,912,000	–[b]	1,766,079	1,650,441	–6.6
Oregon	8,137,000	7,190,000	–11.6	–[b]	17,196,000	–[b]	831,394	901,254	8.4
Utah	6,169,000	6,208,000	<1.0	–[b]	10,620,000	–[b]	8,843,646	8,046,646	–9.0
Washington	–[c]	–[c]	–	9,786,000	7,935,000	–18.9	7,275,528	7,091,427	–2.5
Wyoming	3,655,000	2,050,000	–43.9	–[b]	5,094,000	–[b]	5,754,332	5,453,845	–5.2
Totals:	49,346,000	54,885,000	11.2	–[b]	138,689,000	–5.2[d]	86,995,508	82,867,540	–4.8

[a] NPS data are reported for calendar year (January through December).

[b] Data for 2000 not available.

[c] Washington's total is included with Oregon.

[d] Value based on data from Arizona, California, Colorado, Idaho, Montana, and Washington only.

Sources: BLM (2001a, 2006h); Parker (2007); NPS (2001, 2006b).

hazardous substances and other pollutants, with the greatest number (1,234 sites, or 34%) having occurred in California. Four other states had release sites numbering more than 10% of the total: Arizona (589), Idaho (456), Nevada (464), and Oregon (357). Of the total sites, 3,029 have been closed and administratively archived with no further action planned. During FY2005, 330 removal actions and one remedial action were conducted on BLM lands in the 11 western states (BLM 2006h).

4.5.12 Population Trends

The West is the fastest growing region in the United States. Between 1990 and 2000, it grew at a faster rate (19.7%) than the nation as a whole (13.2%). Five western states had population increases greater than 25% in the 10-year period, with Nevada growing by more than 66% (Table 4.5-13). The West is also the most urbanized of the four U.S. regions, with more than 88% of the population living in urban areas in 2000 (Table 4.5-14). In 2000, the percentages of populations living in urban areas in seven of the 11 western states were at or above the national average of 79%, with the highest being California (at 94.4%) (BLM 2004f).

The BLM (2004f) also reports an important trend in the relationship between the amount of public land and the population growth in western state counties. In 1994, the ERS classified counties in the 11 western states into three groups: metropolitan (22% of counties); nonmetropolitan nonpublic lands (31% of counties); and nonmetropolitan public lands (47% of counties). *Nonmetropolitan public*

TABLE 4.5-13 Population Change in the 11 Western States and the United States from 1990 to 2000

	Population in 1990	Population in 2000	Percent Increase 1990 to 2000
States:			
Arizona	3,665,228	5,130,632	40.0
California	29,760,021	33,871,648	13.8
Colorado	3,294,394	4,301,261	30.6
Idaho	1,006,749	1,293,953	28.5
Montana	799,065	902,195	12.9
Nevada	1,201,833	1,998,257	66.3
New Mexico	1,515,069	1,819,046	20.1
Oregon	2,842,321	3,421,399	20.4
Utah	1,722,850	2,233,169	29.6
Washington	4,866,692	5,894,121	21.1
Wyoming	453,588	493,782	8.9
Regions:			
West	52,786,082	63,197,932	19.7
Northeast	85,445,930	100,236,820	17.3
Midwest	59,668,632	64,392,776	7.9
South	50,809,229	53,594,378	5.5
Totals for United States	248,709,873	281,421,906	13.2

Source: BLM (2004f).

TABLE 4.5-14 Rural and Urban Populations in the 11 Western States and the United States from 1990 to 2000

	Urban 1990 (%)	Rural 1990 (%)	Urban 2000 (%)	Rural 2000 (%)	Urban Increase 1990 to 2000
States:					
Arizona	87.5	12.5	88.2	11.8	0.7
California	92.6	7.4	94.4	5.6	1.8
Colorado	82.4	17.6	84.5	15.5	2.0
Idaho	57.4	42.6	66.4	33.6	9.0
Montana	52.5	47.5	54.1	45.9	1.5
Nevada	88.3	11.7	91.5	8.5	3.2
New Mexico	73.0	27.0	75.0	25.0	2.0
Oregon	70.5	29.5	78.7	21.3	8.3
Utah	87.0	13.0	88.2	11.8	1.2
Washington	76.4	23.6	82.0	18.0	5.6
Wyoming	65.0	35.0	65.1	34.9	0.1
Regions:					
West	86.3	13.7	88.6	11.4	2.4
Northeast	78.9	21.1	84.4	15.6	5.5
Midwest	71.7	28.3	74.7	25.3	3.0
South	68.6	31.4	72.8	27.2	4.2
Total for United States	75.2	24.8	79.0	21.0	3.8

Source: BLM (2004f).

lands were defined as counties with federal lands occupying more than 30% of the total area. Between 1990 and 2000, counties designated by the ERS as *nonmetropolitan public land* experienced an increase in population of 25%, about 10% higher than the increase for counties designated *nonmetropolitan nonpublic land* and 5% higher than the increase for counties designated *metropolitan* over the same period. This disproportionate rate of population increase is changing the social context of public lands throughout the West.

4.6 WHAT ARE THE CUMULATIVE IMPACTS?

Corridor designation and land use plan amendments under the Proposed Action will not contribute to cumulative impacts to resources in the 11 western states. However, the construction and operation of energy transport projects within designated corridors could contribute to cumulative impacts affecting both federal and nonfederal land. The level of contributions of these projects to cumulative impacts may vary depending on the number of projects colocated within a given corridor segment and whether projects occur simultaneously or over a longer span of time. For example, multiple projects involving pipelines could increase the risk of groundwater degradation relative to single projects if they were to occur simultaneously or within a short time span. Colocated projects also increase this risk across the area over which they extend. The cumulative impacts analyses presented in the following sections encompass the direct and indirect impacts associated with both the period of energy transport project construction and the postconstruction period of operation (covered in Chapter 3) for corridor designation and development, and the potential impacting factors for activities associated with reasonably foreseeable future actions (Table 4.6-1).

Project development within designated corridors combined with other past, present, and reasonably foreseeable future actions could affect all resource areas; however, the most significant impacts would be to ecological and visual resources. Impacts to geologic resources (including soil), air quality, socioeconomics, and those resulting from noise due to corridor construction would be short in duration (for the construction period) and would therefore not likely contribute significantly to cumulative impacts. For this analysis, it is assumed that the requirements of the IOPs and mitigation measures identified in this PEIS would be met. These IOPs and mitigation measures would require comprehensive, ongoing environmental monitoring programs to evaluate environmental conditions and adjust impact mitigation objectives, as necessary, and would reduce the contribution of corridor designation and development to cumulative impacts for most resource areas. Table 4.6-2 provides a summary of cumulative impacts in the 11 western states (based on the analysis of the general development trends described in Section 4.5) for each resource area and the contributions to these impacts from the Proposed Action.

4.6.1 Land Use

The cumulative impacts of past, present, and future land use trends in the 11 western states relate to the increase in urbanization of private land and the increase of commercial, industrial, and recreational use of public lands. Under the Proposed Action, corridor designation could indirectly affect current land use on about 1.68 million acres along 3,696 miles of federal land not previously designated at the local level for energy transport. Land use and property values on nonfederal land could also be affected by the corridor designations under the Proposed Action. Corridor development is generally compatible with many land uses, including livestock grazing and recreation. However, significant impacts could result in areas where permanent loss of productive use or future use (e.g., mining or military operations) occurred. Consultation with the appropriate managing agency would ensure compatibility between corridor development and the current and planned land uses in the project area.

4.6.2 Geologic Resources

The cumulative impacts of past, present, and future actions on geologic resources in the 11 western states relate to the increased use of geologic materials for construction activities associated with oil and gas development and production, mining, renewable energy development, timber harvesting (e.g., road building), and transportation; and the increased potential for soil erosion due to ground disturbance occurring during these activities. The development of energy transport projects within designated corridors would contribute to these impacts; however, since sand, gravel, and crushed stone are abundant in the 11 western states, the volume needed for future energy transport projects is not expected to adversely affect the availability of these resources over the long term. The potential for soil erosion would be low to moderate during the initial construction phase and any other construction periods that could occur over the next 20 years, but was short in duration. Soil erosion and contamination could occur during the operational phase, but would be of limited extent and magnitude.

4.6.3 Paleontological Resources

The cumulative impacts of past, present, and future actions on paleontological resources in the 11 western states relate to the increased accessibility that may accelerate erosional processes over time and expose fossils, leaving them vulnerable to theft and vandalism. Ground-

TABLE 4.6-1 Potential Impacting Factors of Activities Associated with Reasonably Foreseeable Future Actions in the 11 Western States by Resource Area

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Geologic Resources:		
Earthmoving/blasting	Soil disturbance/erosion	A, B, C, D, F, K
Construction	Resource use	A, B, C, D, F, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Soil disturbance Elimination/reduction of contamination	A, B, C, D, F, G
Paleontology:		
Earthmoving/blasting	Soil disturbance/erosion Resource damage/destruction	A, B, C, D, F, K
Vegetation clearing/roads	Increased accessibility Vandalism/theft	A, B, C, D, E, F
Water Resources –		
Groundwater:		
Construction/operations	Resource use	A, B, C, D, F, I, J, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Elimination/reduction of contamination	A, B, C, D, F, G
Surface Water:		
Earthmoving/blasting	Soil disturbance/erosion	A, B, C, D, F, K
Construction/operations	Resource use	A, B, C, D, F, I, J, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Elimination/reduction of contamination	A, B, C, D, F, G
Air Quality:		
Earthmoving/blasting	Dust emissions	A, B, C, D, F, K
Vegetation clearing/roads	Dust emissions	A, B, C, D, F, K
Equipment/vehicles	Exhaust emissions	A, B, C, D, E, F, J, K
Facility operations	Fuel combustion emissions	A, B, C, D, F, K
Spills/releases	Evaporative emissions (from crude oil, petroleum products, and hazardous chemicals)	A, B, C, D, F, G
Noise:		
Earthmoving/blasting	Increased ambient noise levels	A, B, C, D, F, K
Construction/operations	Increased ambient noise levels	A, B, C, D, E, F
Traffic	Increased ambient noise levels	A, B, C, D, E, F, J, K
Corona effects	Increased ambient noise levels	C
Aircraft surveillance	Increased ambient noise levels	C

TABLE 4.6-1 (Cont.)

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Ecological Resources – Vegetation and Wetlands:		
Vegetation clearing/roads	Injury/destruction Habitat disturbance/loss Reduced growth/density Increased invasive vegetation Dust emissions Hydrological changes (flow, temperature)	A, B, C, D, E, F, I, K
Construction/operations	Injury/destruction Habitat disturbance/loss Dust emissions Hydrological changes (flow, temperature)	A, B, C, D, E, F, K
Spills/releases	Increased exposure risk Injury/mortality	A, B, C, D, F, G
Ecological Resources – Aquatic Biota and Wildlife:		
Vegetation clearing/roads	Injury/mortality Interference with behavioral activities Habitat disturbance/loss Increased noise Dust emissions	A, B, C, D, E, F, G, I, J, K
Construction/operations	Injury/mortality Interference with behavioral activities Habitat disturbance/loss Increased noise Dust emissions	A, B, C, D, E, F, G
Spills/releases	Increased exposure risk Injury/mortality	A, B, C, D, F, G
Visual Resources:		
Urbanization	Decreased visibility (light pollution)	K
Vegetation clearing/roads	Increased contrast with surrounding landscape	A, B, C, D, E, F, K
All-terrain vehicle use	Degradation of visual quality	J
Tower/facility construction	Increased contrast with surrounding landscape	A, B, C, D
Operations	Decreased visibility	A, B, C, D, F
Cultural Resources:		
Earthmoving/blasting	Soil disturbance/erosion Resource damage/destruction	A, B, C, D, E, F, G, H, I, J, K
Vegetation clearing/roads	Increased accessibility Vandalism/theft	A, B, C, D, E, F, G, H, I, J, K

TABLE 4.6-1 (Cont.)

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Socioeconomics:		
Construction/operations	Increased housing needs Increased expenditures Increased employment Increased taxes/revenues Change in private property values	A, B, C, D, E, F, J, K
Environmental Justice:		
Construction/operations	Noise Dust emissions EMF effects Degradation of visual quality Change in private property values	A, B, C, D, E, F
Health and Safety:		
Exploration	Occupational hazards	A, B
Construction/operations	Occupational hazards	A, B, C, D, E, F, J, K
Air emissions	Respiratory impairment	A, B, D, F, G
Spills/releases	Increased exposure risks	A, B, C, D, F, G
Land Use:		
Construction/operations	Conflicts in land use Increased human activity	A, B, C, D, E, F, G, H, I, J, K

[a] Key to actions: A = oil and gas exploration, development, and production; B = mineral exploration, development, and production; C = transmission and distribution systems; D = renewable energy development; E = commercial timber harvest; F = transportation; G = legislative actions related to land use; H = land management; I = grazing and rangeland management; J = tourism and recreation; K = property development.

disturbing activities associated with ROW clearing, construction of the transmission systems and required infrastructure, and increased accessibility on public lands could damage or destroy fossil remains and disrupt the contexts in which they are found. The contribution of future project development to adverse cumulative impacts to paleontological resources in the 11 western states may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

4.6.4 Water Resources

4.6.4.1 Groundwater Resources

The cumulative impacts of past, present, and future actions on the availability and quality of groundwater resources throughout the 11 western states are variable and area-specific. In general, the potential for groundwater degradation increases with the number of energy-related projects because of the increased

TABLE 4.6-2 Anticipated Cumulative Impacts in the 11 Western States and Contributions from the Proposed Action by Resource Area

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Land Use	4.6.1	The cumulative impacts of the past, present, and future land use trends relate to the increase in urbanization of private lands and the increase of commercial, industrial, and recreational uses of public lands.	Corridor designation could indirectly affect current land use on about 1.68 million acres of federal land, and land use and property values on adjacent nonfederal land. Corridor development under the Proposed Action is generally compatible with many land uses; however, significant impacts could result in areas where permanent loss of productive use or future use (e.g., mining or military operations) occurred. Consultation with the appropriate managing agencies would ensure compatibility between corridor development and the current and planned land uses in the project area.
Geologic Resources	4.6.2	Cumulative impacts relate to the increased use of geologic materials for construction activities associated with oil and gas development and production, mining, renewable energy development, timber harvesting, and transportation; and the increased potential for soil erosion due to ground disturbance.	Corridor designation is not expected to contribute to cumulative impacts. Construction activities would not impact the availability of geologic resources or increase the soil erosion potential over the long term. Soil erosion and contamination could occur during operational phase, but would be of limited extent and magnitude.
Paleontological Resources	4.6.3	Cumulative impacts relate to the increased accessibility that may accelerate erosional processes over time and expose fossils, leaving them vulnerable to theft and vandalism.	Corridor designation is not expected to contribute to cumulative impacts. However, the contribution of energy transport project construction and operation to adverse cumulative impacts may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Water Resources	4.6.4	*Groundwater:* The cumulative impacts of past, present, and future actions to the availability and quality of groundwater are variable and area-specific; however, the potential for groundwater degradation increases with the number of energy-related projects in the 11 western states. Groundwater availability could be affected by activities that change recharge patterns, groundwater depth, or groundwater flow direction or volume. *Surface Water:* The cumulative impacts of past, present, and future actions relate to changes in the patterns and rates of surface runoff (and erosion) and water quality as a result of earthmoving activity associated with energy-related projects and urban development, which are on the rise in the 11 western states. The potential for surface water degradation also increases with the number of energy-related projects in the 11 western states.	*Groundwater:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts related to groundwater degradation, especially along corridor segments where pipelines would be installed if spills were to occur in the future. Projects are not expected to impact groundwater availability over the long term. *Surface Water:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts related to surface water degradation, especially along corridor segments where pipelines would be installed if spills were to occur in the future. Projects are not expected to impact surface water runoff over the long term.
Air Quality	4.6.5	The cumulative impacts of past, present, and future actions relate to increased pollutant loads associated with oil and gas development and production, mining, and increased traffic (due to increases in population and tourism).	Corridor designation is not expected to contribute to cumulative impacts. The contribution of an energy transport project to cumulative impacts would depend on the mix of technologies and the location of emission sources within a multiple transmission system. Emissions associated with construction activities would be localized and short in duration.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Noise	4.6.6	The cumulative impact of past, present, and future actions due to noise are associated with oil and gas development and production, mining, renewable energy development, timber harvesting, and traffic.	Corridor designation is not expected to contribute to cumulative impacts. The contribution of energy transport project construction and operation to cumulative impacts during ROW construction would be high, but localized and short in duration. Noise sources during the operations phase would include compressor/pump stations, aircrafts for pipeline surveillance and monitoring, corona noise from transmission lines, and substations. These, along with periodic repair and maintenance activities, would contribute to adverse noise impacts over the long term.
Ecological Resources	4.6.7	*Vegetation and Wetlands:* The cumulative impacts of past, present, and future actions to vegetation and wetlands result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and destruction of vegetation, reduced growth and density, habitat disturbance (fragmentation) or loss, and increased growth of invasive species.	*Vegetation and Wetlands:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects would contribute to cumulative impacts. Vegetation along streams and rivers may be affected where they intersect the corridor segments. Wetland concentration areas, as well as other sensitive ecological resources, were considered during corridor routing.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Aquatic Biota:* The cumulative impacts of past, present, and future actions to aquatic biota result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., obstructions to fish movement), and increased risk of toxic release exposures.	*Aquatic Biota:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute significantly to cumulative impacts as a result of thermal effects and water quality degradation.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Wildlife:* The cumulative impacts of past, present, and future actions to wildlife result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures.	*Wildlife:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute significantly to cumulative impacts as a result of various project-related stressors (e.g., habitat disturbance or exposure to contaminants).

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Threatened, Endangered, and Special Status Species:* The cumulative impacts of past, present, and future actions to threatened, endangered, and other special status species result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures.	*Threatened, Endangered, and Special Status Species:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to adverse cumulative impacts to threatened, endangered, and other special status species. Since these impacts would be variable and species-specific, they need to be assessed on a project-specific basis through NEPA evaluations and ESA consultations prior to development.
Visual Resources	4.6.8	The cumulative impacts of past, present, and future actions to visual resources relate to activities associated with urbanization, oil and gas development and production, mining, renewable energy development, timber harvesting, increased recreation activities (e.g., ATV use), and increased traffic (due to increases in population and tourism).	Corridor designation is not expected to contribute to cumulative impacts. The contribution of energy transport project construction and operation to cumulative impacts is expected to be large, particularly in areas without existing transport facilities and cleared ROWs. Adverse impacts would be greatest on steeply sloped areas with low vegetation diversity and a lack of screening vegetation, and in forested areas because of the high degree of contrast created by vegetation removal.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Cultural Resources	4.6.9	The cumulative impacts of past, present, and future actions to cultural resources relate to the potential for damage or destruction of artifacts and their context and increased pedestrian and vehicular traffic, which can increase accessibility to artifacts and areas of significance to Native Americans and accelerate erosional processes over time.	Corridor designation is not expected to contribute to cumulative impacts. However, the contribution of energy transport project construction and operation to adverse cumulative impacts may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.
Socioeconomics	4.6.10	The cumulative impacts of past, present, and future actions relate to increased employment, income, and tax revenues associated with oil and gas development and production, mining, timber harvesting, and increases in population and tourism.	Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts. Development may also affect property values on adjacent private land.
Environmental Justice	4.6.11	The cumulative impacts of past, present, and future actions related to disproportionately high and adverse impacts on minority and low-income populations and include accessibility to ecological or cultural resources, property values, and impacts related to activities that generate noise, dust, EMF, and degradation of visual quality.	Corridor designation is not expected to contribute to cumulative impacts. The cumulative impacts of energy transport project construction and operation are not expected to be disproportionately high and adverse since these populations are neither more than 50% of the population of the corridor buffer area or 20 percentage points higher than the minority population percentage in each state (except for New Mexico).
Health and Safety	4.6.12	The cumulative impacts of past, present, and future actions on human health and safety pertain mainly to workforces, but may be of concern to the public. Health impacts on a more regional scale are influenced by the agricultural and industrial trends in a given air shed.	Corridor designation is not expected to contribute to cumulative impacts. The safety impacts of energy transport project construction and operation on human health are of concern mainly for the workforces involved in project construction, operation, and decommissioning. Factors determining the potential for safety impacts to the public include the proximity to the corridor and the number of construction vehicles on public roadways.

risk of hazardous substance releases to the environment. The development of energy transport projects within designated corridors could contribute to adverse impacts over time, particularly along corridor segments where pipelines would be installed if spills were to occur in the future. Project construction and operation are not expected to impact groundwater availability, since only small amounts of water would be used. Other factors not related to past, present, and future actions (e.g., precipitation and recharge rates) can have an important effect on the availability of groundwater resources.

4.6.4.2 Surface Water Resources

The cumulative impacts of past, present, and future actions to surface water resources throughout the 11 western states relate mainly to changes in the patterns and rates of surface runoff (and erosion) and water quality. These impacts are the result of earthmoving activities associated with energy-related projects, transportation, and urbanization, all of which are on the rise in the West. Increased sediment loading associated with erosion is also caused by ground disturbance (e.g., during earthmoving phases of construction) and can degrade the quality of surface water. The contribution of the development of energy transport projects within designated corridors to these impacts is expected to be low to moderate during the project construction phase and short in duration. Over the long term, project construction and operation are not expected to adversely affect surface runoff.

The potential for surface water contamination increases with the number of energy-related projects because of the increased risk of hazardous substance releases to the environment. Project construction and operation could contribute to adverse impacts over time, particularly along corridor segments where pipelines would be installed if spills were to occur in the future.

4.6.5 Air Quality

The cumulative impacts of past, present, and future actions to air quality in the 11 western states relate to increases in pollutant loads associated with oil and gas development and production, mining, and increased traffic (due to increases in population and tourism). The contribution of an energy transport project to these impacts would depend on the mix of technologies deployed and the location of emission sources within a multiple transport system.

Project construction activities could contribute to regional pollutant loads (including particulates, CO, NO_x, SO_2, and VOCs) from construction equipment and vehicle exhaust emissions if multiple construction projects were to occur simultaneously. Otherwise, these emissions would be fairly localized and short in duration. Increased particulates would also result from fugitive dust emissions along unpaved roads, in areas where the vegetative cover has been removed, and during earthmoving activities (including blasting). Batch plant operations during construction would also add to these emissions.

4.6.6 Noise

The cumulative impacts of past, present, and future actions because of noise result from the increased construction and operation activities associated with oil and gas development and production, mining, renewable energy development (e.g., construction of turbine towers for the development of wind energy), and timber harvesting. Increased traffic along transportation routes also contributes to the adverse cumulative effects of noise. The contribution of the construction of energy transport projects to these impacts is expected to be high during the ROW construction phase as the result of using heavy earthmoving equipment and blasting bedrock (in some areas), but would be localized and short in duration. Over the long term, contributions to adverse cumulative impacts resulting from noise sources would be associated with the project operations phase. Noise sources would include compressor/pump stations; aircraft used for pipeline surveillance and monitoring; corona noise from transmission lines; and substations. Repair and maintenance activities requiring the short-term use of vehicles and heavy equipment would also contribute to adverse noise impacts over the long term.

4.6.7 Ecological Resources

4.6.7.1 Vegetation and Wetlands

The cumulative impacts of past, present, and future actions on vegetation and sensitive habitats like wetlands and riparian zones along rivers and streams result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and the installation of facilities and infrastructure), which are associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, and changes in water temperature and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury to and destruction of vegetation, reduced growth and density, habitat disturbance (fragmentation) or loss, and increased growth of invasive species (reducing species diversity and increasing the frequency and intensity of wildfires). The construction and operation of energy transport projects would contribute to these impacts. Impacts to riparian habitats along rivers and streams would be expected in areas where they intersect designated corridors. The locations of wetland concentration areas, as well as other sensitive ecological resources, were considered during corridor routing.

4.6.7.2 Aquatic Biota

The cumulative impacts of past, present, and future actions on aquatic biota result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Changes in water temperature and degradation of water quality from increased turbidity, sedimentation, or contamination would also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., obstructions to fish movement), and increased risk of toxic release exposures. All life stages of aquatic biota, including eggs, larvae, and adults, could be affected. The construction and operation of energy transport projects under the Proposed Action could contribute significantly to these impacts.

4.6.7.3 Wildlife

The cumulative impacts of past, present, and future actions on wildlife result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures. The construction and operation of energy transport projects under the Proposed Action could contribute significantly to these impacts.

4.6.7.4 Threatened, Endangered, and Other Special Status Species

The cumulative impacts of past, present, and future actions on threatened, endangered, and other special status species result from the increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Corridor designation is not expected to contribute to cumulative impacts to threatened and endangered species. However, the construction and operation of energy transport projects under the Proposed Action could contribute to the adverse cumulative impacts incurred by these species from other anthropogenic activities. Impacts to threatened and endangered species and designated critical habitat would be variable and species-specific. These impacts would need to be assessed on a project-specific basis through NEPA evaluations and ESA consultations prior to development.

4.6.8 Visual Resources

The cumulative impacts of past, present, and future actions to visual resources in the 11 western states relate mainly to activities associated with urbanization, oil and gas development and production, mining, renewable energy development (e.g., construction of turbine towers for the development of wind energy), timber harvesting, increased recreation activities (e.g., ATV use), and increased traffic (due to increases in population and tourism). Long-term impacts include decreased visibility (e.g., light pollution, increased contrast with surrounding landscape, and degradation of visual quality of the landscape). The contribution of the construction and operation of energy transport projects under the Proposed Action to these impacts is expected to be large, particularly in areas without existing energy transport facilities and cleared ROWs. Adverse impacts due to ROW clearing would be greatest in landscapes with low visual absorption capability (the degree to which the landscape can absorb visual impacts without serious degradation in perceived scenic quality) such as steeply sloped areas with low vegetative diversity and a lack of screening vegetation, and in forested areas because of the high degree of contrast created by vegetation removal. Contributions to the cumulative impacts would be highest in areas where long-distance visibility is greatest.

4.6.9 Cultural Resources

The cumulative impacts of past, present, and future actions on cultural resources in the 11 western states relate to the potential for damage or destruction of artifacts and their context and increased pedestrian and vehicular traffic, which may increase accessibility to artifacts and areas of significance to Native Americans and accelerate erosional processes over time. The contribution of future project development to adverse cumulative impacts to cultural resources in the 11 western states may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

4.6.10 Socioeconomics

The cumulative impacts of past, present, and future actions relate to increased employment, personal income, and tax revenues associated with oil and gas development and production, mining, timber harvesting, and increases in population and tourism. The construction and operation of energy transport projects under the Proposed Action would contribute to these impacts. Development may also affect property values on adjacent private land.

4.6.11 Environmental Justice

Potential impacts to low-income and minority populations could be incurred as a result of the construction and operation of project-specific infrastructure under the Proposed Action; however, because impacts are likely to be small, and because there are no low-income or minority populations defined by CEQ guidelines (see Section 3.13.1) in the 11 states (with the exception of New Mexico where there is a minority population), impacts of corridor designation would not disproportionately affect low-income or minority populations.

4.6.12 Health and Safety

The cumulative impacts of past, present, and future actions on human health and safety are of concern mainly for the workforces involved in project construction, operation, and decommissioning. These include but are not limited to exposure to physical hazards from use of heavy equipment, injury from contact with energy sources (e.g., electrical), exposure to noise and hazardous materials (gases, gusts, or fumes), heat and cold stress, and bites and injuries from contact with dangerous animals, insects, or plants. Some health and safety concerns may impact the public, although these impacts generally decrease with increasing distance from the project of interest. Safety impacts to the public would occur mainly during construction and decommissioning due to transportation of heavy or oversize loads and movement of construction vehicles along public roadways, and would be relatively short in duration. Multiple projects occurring simultaneously or within a short time span could increase the potential for traffic accidents; however, this would be of short duration (during construction and decommissioning phases only). The contributions of energy transport projects under the Proposed Action to these impacts are variable and area-specific. Factors determining the potential for health impacts to the public include the agricultural and industrial trends in a given air shed, which can affect air quality and the incidence of air quality-related health problems.