CHAPTER 3 – AFFECTED ENVIRONMENT

This chapter describes existing conditions for Bureau of Land Management (BLM) resource programs, resource uses, and special designations, and the socioeconomic environment in the Bighorn Basin Planning Area. As summarized in Chapter 1, various laws, regulations, policies, and other requirements direct management of resources and resource uses on BLM-administered public lands. The Cody Field Office (CYFO) and Worland Field Office (WFO), which comprise the Planning Area, operate under these requirements and guidance. The CYFO and WFO also consider Best Management Practices (BMP) in the management of resources and resource uses in the Planning Area.

In addition to describing existing conditions, where appropriate this chapter identifies management challenges for resource programs and resource uses on BLM-administered lands. The BLM identified these management challenges through its Analysis of the Management Situation (AMS), and by issues identified during the scoping process for the Bighorn Basin Resource Management Plan (RMP) Revision. Because it describes existing conditions in the Planning Area, this chapter serves as the baseline against which the BLM analyzes and compares impacts of alternatives A through F in Chapter 4.

Overview of the Planning Area

The Planning Area comprises 3,187,814 acres of BLM-administered federal surface lands (Map 1) and 4,203,213 acres of BLM-administered federal mineral estate (Map 2) in Big Horn, Hot Springs, Park, and Washakie counties in north-central Wyoming. The CYFO extends west beyond the Bighorn Basin, but generally, the United States Department of Agriculture (USDA) Forest Service (USFS) and the National Park Service manage those lands; therefore, this RMP and Environmental Impact Statement (EIS) does not consider them. In each of the four counties there are large contiguous areas of BLM-administered land and smaller tracts of BLM-administered land interspersed with private and state land. There is a checkerboard pattern of state, private, and BLM-administered lands in the northwestern portion of the Planning Area.

The Planning Area lies within two Major Land Resource Areas (MLRA) – the Northern Intermountain Desertic Basins and Central Rocky Mountains. The Planning Area is in the Bighorn Basin, an asymmetric heart-shaped intermontane basin of the Rocky Mountain foreland in north-central Wyoming and south-central Montana. The basin is surrounded by mountainous uplifts, including the Big Horn and Pryor Mountains to the east and northeast, respectively, the Owl Creek Mountains to the south, the Absaroka Range to the west, and the Beartooth Mountains to the northwest (Roberts and Rossi 1999). The central low-lying part of the basin is dominated by desert shrubland and grasslands. At high elevations the dominant vegetation transitions from sagebrush and grassland to mountain shrublands and ultimately to coniferous forests. The Planning Area generally has a dry, windswept, rain-shadow climate like much of the state of Wyoming, but variations in elevation have a substantial effect on vegetation types and suitability of areas for agriculture and grazing.

The topography of the Planning Area varies from rolling plains, flat mesas, and badlands to alluvial valleys, benches, foothills and mountains (BLM 1993). Elevations in the Planning Area range from approximately 3,552 feet above mean sea level (amsl) in the middle of the basin to 11,657 feet amsl in the higher mountain ranges.

The Bighorn River and its tributaries (including the Shoshone, Nowood, Greybull and Wood Rivers, and Owl, Gooseberry, Cottonwood, Shell, Nowater, Kirby and Fifteenmile Creeks) drain the Bighorn Basin. The Clarks Fork of the Yellowstone River also drains the basin.

Basin climate is arid to semi-arid. Precipitation in the central basin is less than 10 inches per year, but up to 40 or more inches per year in the mountainous regions surrounding the basin (BLM 1993). The average annual temperature in the basin is approximately 44 degrees Fahrenheit (°F), but substantially colder in the mountain regions.

Soils and vegetation in the Planning Area generally provide rangeland suitable for year-round livestock grazing in the lower elevations. Higher elevations are generally grazed during summer and/or fall. Livestock grazing includes the grazing of domestic animals such as cattle, sheep, horses, and bison.

Agricultural production in the Planning Area is limited by low precipitation and scarcity of surface water. Major crops in the Planning Area include spring wheat, barley, oats, dry beans, sugar beets, alfalfa hay, and corn (Headwaters Economics 2007a).

Big Horn County

Big Horn County was organized in 1897, created from parcels taken from Johnson, Fremont, and Sheridan counties. In the same year, Basin, Wyoming, was named as the county seat. A portion of the Big Horn County National Recreation Area, which straddles the Wyoming-Montana state line, is in Big Horn County. The United States (U.S.) Department of Defense also administers a small parcel of land in Big Horn County.

The Bighorn River watershed, which drains the entire basin, flows through the middle of the county. Bighorn National Forest is along the eastern portion of the county and is comprised primarily of the foothills and higher mountain regions of the Big Horn Mountains.

The principle industries in Big Horn County are bentonite mining, farming, sugar-beet and bean processing, and tourism.

U.S. Highways 20 and 310 are the main north-south arteries in Big Horn County. U.S. Highway 14 traverses east-west, intersecting Highway 20 in Greybull.

Big Horn County is comprised of approximately 1,664,796 surface acres in the Planning Area, of which the BLM administers approximately 1,157,920. In addition, the BLM administers approximately 1,288,238 acres of federal mineral estate in Big Horn County.

Hot Springs County

Hot Springs County was established in 1911, the same year Thermopolis, Wyoming, was named the county seat. The county's name is derived from geothermal features that attract tourists to the county.

Most of the Wind River Canyon, with the Owl Creek Mountains on the west and the Bridger Mountains on the east, is in Hot Springs County. The Big Horn Mountains ring the eastern portion of the county, with the Absaroka Range to the west.

State Highway 789 and U.S. Highway 20 are the main north-south corridors in Hot Springs County. The county is also served by Wyoming Highway 120, which runs northwest from Thermopolis, through Meeteetse, and on to Cody.

The smallest county by area in Wyoming, Hot Springs County also has the fewest BLM-administered surface and mineral estate acres in the Planning Area. Hot Springs County is comprised of approximately 984,429 surface acres in the Planning Area, of which the BLM administers approximately 500,631. In addition, the BLM administers approximately 741,151 acres of federal mineral estate in Hot Springs County.

Park County

The largest county by area in the Planning Area, Park County also is the most populous, with approximately 27,000 residents in 2005 (Headwaters Economics 2007b). A large portion of Park County is in Yellowstone National Park, which the National Park Service administers.

What is now Park County was first a part of Sweetwater County, then Fremont County, and then Big Horn County, until 1909 when the Wyoming State Legislature defined and set aside the boundaries of Park County. Cody, Wyoming, named for William "Buffalo Bill" Cody, was chosen as the county seat the following year.

Three rivers flow through Park County – the Greybull and Shoshone Rivers, which are tributaries to the Bighorn River, and the Clarks Fork of the Yellowstone River, which flows into the Yellowstone River. Three highways serve Park County (U.S. Highway 14-16-20 east and west, U.S. Highway 14 Alternate, and Wyoming 120 north and south).

The major industries in Park County are oil and gas production, agriculture, and tourism. Park County is comprised of approximately 1,618,644 surface acres in the Planning Area, of which the BLM administers approximately 624,870. In addition, the BLM administers approximately 1,049,904 acres of federal mineral estate in Park County.

Washakie County

Washakie County was organized in 1911 and named after the head chief of the Shoshone people, Chief Washakie. The county seat of Washakie County is Worland, Wyoming.

The western part of Washakie County is intensively irrigated farmlands that lie adjacent to the Bighorn River, which winds its way through Worland. Other farmlands are along the Gooseberry and Cottonwood Creeks. The agriculture of the eastern part of Washakie County is based primarily on the production of sheep and cattle (Washakie County Conservation District 2009).

U.S. Highway 16 is the main east-west corridor in the county, passing over the Big Horn Mountains and through Ten Sleep, before turning north in Worland. State Highway 789 and U.S. Highway 20 are the main north-south arteries in Washakie County.

Washakie County is comprised of approximately 1,375,849 surface acres in the Planning Area, of which the BLM administers approximately 903,846. In addition, the BLM administers approximately 1,123,281 acres of federal mineral estate in Washakie County.

3.1 Physical Resources

Physical resources in the Planning Area include air quality, geologic resources, soil, water, and cave and karst resources. The following five resource sections define and describe the resource, its existing condition, and any management challenges for the resource.

3.1.1 Air Quality

This section describes the climate and existing air quality in the region potentially affected by the six alternatives described in Chapter 2. Air pollutants addressed include criteria pollutants, hazardous air pollutants (HAPs), and sulfur and nitrogen compounds that could impair visibility or cause atmospheric deposition, including acid rain.

Air Quality Indicators

Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) identify maximum limits for concentrations of criteria air pollutants at all locations to which the public has access. The WAAQS and NAAQS are legally enforceable standards. Concentrations above the WAAQS and NAAQS represent a risk to human health that, by law, require public safeguards to be implemented. State standards must be at least as protective of human health as federal standards, and may be more restrictive than federal standards, as allowed by the Clean Air Act. The Wyoming Prevention of Significant Deterioration (PSD) program establishes allowable increases of a given pollutant for a particular area from specific sources.

In Wyoming, it is the responsibility of Wyoming Department of Environmental Quality (DEQ) Air Quality Division, subject to United States Environmental Protection Agency (EPA) oversight, to ensure compliance with federal and state air quality standards; setting maximum allowable limits (NAAQS and WAAQS) for six criteria pollutants—CO (carbon monoxide), SO_2 (sulfur dioxide), NO_2 (nitrogen dioxide), O_3 (ozone) and particulate matter (PM_{10} and $PM_{2.5}$); and setting maximum allowable increases (PSD Increments) above legal baseline concentrations for three of these pollutants (SO_2, NO_2, and PM_{10}) in Class I and Class II areas.

Criteria Air Pollutants

The EPA established air quality standards (NAAQS) for criteria pollutants. Criteria pollutants include CO, NO_2, O_3, PM_{10} and $PM_{2.5}$, SO_2, and lead (Pb). Air-pollutant concentrations greater than the NAAQS represent a risk to human health.

Hazardous Air Pollutants

There are a wide variety of HAPs, including benzene, toluene, ethylbenzene, xylene (also referred to as BTEX), N-hexane, and formaldehyde. There are no federal air quality standards for HAPs (there are exposure thresholds), but some states have established “significance thresholds” to evaluate human exposure for potential chronic inhalation illness and cancer risks.

Visibility

Visibility, also referred to as visual range, is a subjective measure of the distance that light or an object can clearly be seen by an observer. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. It is expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person, which is approximately a 10 percent

change in light extinction. To estimate potential visibility impairment, monitored aerosol concentrations are used to reconstruct visibility conditions for each day monitored. The aerosol species include ammonium sulfate, ammonium nitrate, organic mass, elemental carbon, soil elements, and coarse mass. The daily values are then ranked from clearest to haziest and divided into three categories to indicate the mean visibility for all days (average), the 20 percent of days with the clearest visibility (20 percent clearest), and the 20 percent of days with the worst visibility (20 percent haziest). Visibility can also be defined by standard visual range (SVR) measured in miles, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon; the larger the SVR, the cleaner the air.

Since 1980, the Interagency Monitoring of Protected Visual Environments (IMPROVE) network has measured visibility in national parks and wilderness areas. These are managed as high visual quality Class I and II areas under the federal visual resource management (VRM) program. There are six IMPROVE stations in Wyoming, including one in the Planning Area at the North Absaroka site and two adjacent to the Planning Area (in the BLM Buffalo Field Office planning area) at the Thunder Basin National Grasslands and Cloud Peak National Wilderness areas.

Atmospheric Deposition

Atmospheric deposition refers to processes in which air pollutants are removed from the atmosphere and deposited into terrestrial and aquatic ecosystems. Air pollutants can be deposited by precipitation (rain and snow) or the gravitational settling of gaseous pollutants on soil, water, and vegetation. Much of the concern about deposition is due to secondary formation of acids and other compounds from emitted nitrogen and sulfur species, such as oxides of nitrogen (NO_x) and SO_2, which can contribute to acidification of lakes, streams, and soils and affect other ecosystem characteristics, including nutrient cycling and biological diversity.

Substances deposited include:

- Acids, such as sulfuric (H_2SO_4) and nitric (HNO_3), sometimes referred to as acid rain.
- Air toxics, such as pesticides, herbicides, and volatile organic compounds (VOC).
- Heavy metals, such as mercury.
- Nutrients, such as nitrates (NO_3-) and ammonium (NH_4+).

The accurate measurement of atmospheric deposition is complicated by contributions to deposition by several components – rain, snow, cloud water, particle settling, and gaseous pollutants. Deposition varies with precipitation and other meteorological variables (e.g., temperature, humidity, winds, and atmospheric stability), which in turn, vary with elevation and time.

Federal land managers, including the USFS and National Park Service, have established guidelines or Levels of Concern (LOC) for total deposition of nitrogen and sulfur compounds in Class I Wilderness Areas. Total nitrogen deposition of 1.5 kilograms (kg) per hectare (ha) per year or less is considered to be unlikely to harm terrestrial or aquatic ecosystems. For total sulfur deposition, the LOC is 3 kg per ha per year.

Monitoring of Air Quality, Visibility, and Deposition in the Planning Area

Although various state and federal agencies monitor air pollutant concentrations, visibility, and atmospheric deposition throughout Wyoming, at present there are only a few air quality monitors in and near the Planning Area. Table 3-1 lists the available air quality monitoring sites in the Bighorn Basin and relevant sites nearby. The Wyoming DEQ Air Quality Division operates a PM_{10} and $PM_{2.5}$ monitor as part of the State and Local Air Monitoring Site (SLAMS) network in Cody, Wyoming (Park County). Additional SLAMS and Special Purpose Monitoring (SPM) sites operate in nearby counties. These include several IMPROVE monitors and BLM-administered sites that are part of the Wyoming Air Resource Monitoring System (WARMS). The "Basin" WARMS site, located northwest of Worland, has only been operating since 2010 and has a limited data record available. This site was recently upgraded to a full Clean Air Status and Trends Network (CASTNet) site in 2012, but although deposition and SO_2 data are collected at this monitor, only ozone data were available for the analysis presented below. Atmospheric deposition (wet) measurements of NH_4, sulfate (SO_4), and various metals are taken at the Sinks Canyon site, which the BLM operates as part of the National Atmospheric Deposition Program (NADP), as well as the South Pass and Yellowstone Park sites. Figure 3-1 presents a map of northwestern Wyoming and parts of Montana and Utah that includes an outline of the Planning Area, the locations of Class I and II areas, and the locations of the various air quality and meteorological monitors discussed in this analysis.

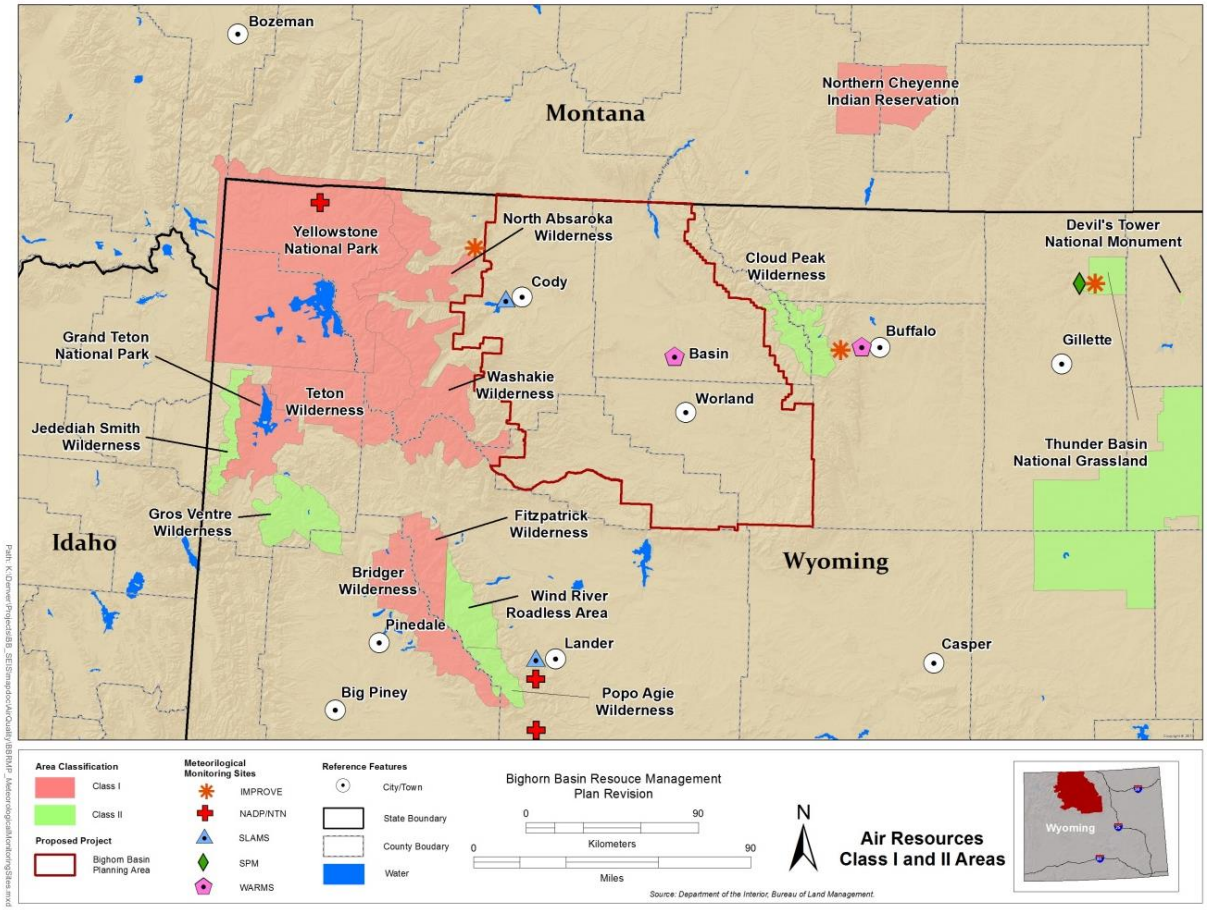
Table 3-1. Air Quality Monitoring Sites In or Near the Planning Area

County	Site Name	Type of Monitor	Parameter	Operating Schedule	Location	
					Longitude	Latitude
Park	Cody	SLAMS	PM_{10}, $PM_{2.5}$	1/6	-109.073	44.532
	North Absaroka (managed by USFS)	IMPROVE	$PM_{2.5}$, NO_{3-}, Ammonium, Nitric Acid, Sulfate, Meteorology	1/3; Hourly Meteorology	-109.382	44.745
	Yellowstone National Park – Tower Falls	NADP/NTN	Wet Deposition Ions, Precipitation, pH	Weekly (Ions); Daily (Precip)	-110.420	44.917
Fremont	Lander	SLAMS	$PM_{2.5}$	1/3	-108.733	42.833
	Sinks Canyon	NADP/NTN	Wet Deposition Ions, Precipitation, pH	Weekly (Ions); Daily (Precip)	-108.850	42.734
	South Pass City	NADP/NTN	Wet Deposition Ions, Precipitation, pH	Weekly (Ions); Daily (Precip)	-108.832	42.494
Big Horn	Basin	WARMS CASTNet	Ozone, NO_{3-}, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/7 (Speciated); Hourly (O3, Met)	-108.041	44.280
Campbell	Thunder Basin	SPM	Ozone, Nitrogen Oxides & Met	Hourly	-105.300	44.672
	Thunder Basin	IMPROVE	$PM_{2.5}$, NO_{3-}, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3 (Speciated); Hourly Met.	-105.287	44.663
Johnson	Buffalo	WARMS	$PM_{2.5}$, NO_{3-}, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3 ($PM_{2.5}$); 1/7 (others); Hourly Met	-106.019	44.144
	Cloud Peak	IMPROVE	$PM_{2.5}$, NO_{3-}, Ammonium, Nitric Acid, Sulfate, Sulfur Dioxide & Meteorology	1/3 (Speciated); Hourly Met	-106.956	44.333

Sources: WARMS 2013; EPA 2013; IMPROVE 2013; Wyoming DEQ 2013b; Wyoming DEQ 2013c; NADP 2013.

IMPROVE Interagency Monitoring of Protected Visual Environments
NO_3 Nitrate
PM Particulate Matter
SLAMS State and Local Air Monitoring Site
SPM Special Purpose Monitoring
USFS United States Forest Service
WARMS Wyoming Air Resource Monitoring System

Figure 3-1. Location of Meteorological and Air Quality Monitoring Sites and Class I and II Areas in Northwest Wyoming



Current Conditions

Climate

The climate in the Planning Area is designated as a combination of Intermountain Semi-desert and Southern Rocky Mountain Steppe. The Bighorn Basin is bounded on the northeast by the Pryor Mountains, on the east by the Big Horn Mountains, on the south by Owl Creek and Bridger and Washakie Ranges, on the west by the Absaroka Mountains, and open to the north into Montana. Summers are generally hot and short, and winters long and cold. Precipitation is generally low, though greater at higher elevations, and is generally evenly distributed across the year, with the exception of the drier summer months. Wind speeds are variable and generally strong. Table 3-2 lists temperature, precipitation, and wind speed data for the Planning Area. This information is derived from daily ambient measurements for 1981 through 2010. The summer period covers June, July, and August; the winter period covers December, January, and February. Based on these limited data, meteorological conditions vary somewhat across the Planning Area, with the Worland area in the middle of the Planning Area showing higher mean maximum summer temperatures, lower mean winter temperatures, and overall drier conditions compared to Cody, which is in the western part of the Planning Area.

Table 3-2. Temperature, Precipitation, and Wind Speed Data for the Planning Area (1981-2010)

Climate Component	Cody, Wyoming	Worland, Wyoming
Mean maximum summer temperatures (June, July, and August) (degrees Fahrenheit)	75.2, 83.8, 82.3	80.7, 90.1, 88.8
Mean minimum winter temperatures (December, January, and February) (degrees Fahrenheit)	15.8, 16.4, 18.2	6.1, 4.3, 10.7
Mean annual temperature (degrees Fahrenheit)	46.8	45.6
Mean annual precipitation (inches)	10.56	7.82
Mean annual snowfall (inches)	42.86	5.1[1]
Mean annual wind speed (miles per hour)	7.7[1]	5.6[1]
Prevailing wind direction	Northerly/westerly[1]	Northerly/southerly[1]

Source: Western Regional Climate Center 2013

[1]Data only available for these parameters for the period 1971-2000

In the Planning Area, the potential effects of climate change on air quality are likely to be varied. For example, if global climate change results in a warmer and drier climate, this could result in increased concentrations of PM due to increased windblown dust from drier and less stable soils. Less snow and an earlier snowmelt could result in a longer wildland fire season, which could lead to higher concentrations of ozone and PM.

Some activities within the Planning Area generate greenhouse gas (GHG) emissions. Oil and gas development activities can generate carbon dioxide (CO_2) and methane (CH_4). CO_2 emissions result from the use of combustion engines, while CH_4 can be released during processing. Wildland fires also are a source of CO_2 and other GHG emissions, while livestock grazing is a source of CH_4. Other activities in the Planning Area with the potential to contribute to climate change include soil erosion from disturbed areas and fugitive dust from roads, which have the potential to darken snow-covered surfaces and cause faster snow melt.

Please see the last section of this chapter for a further discussion of climate change.

Air Quality

With only one long-term air quality monitor (Cody – measuring PM_{10} and $PM_{2.5}$), one relatively new monitor (Basin – measuring ozone, NO_{3-}, ammonium, nitric acid, sulfate, and SO_2) within the Planning Area, and one monitor (North Absaroka/IMPROVE) located just outside the Planning Area, it is difficult to accurately assess existing air quality conditions throughout the area. However, as noted above, air quality, visibility, and atmospheric deposition are monitored throughout Wyoming, including adjacent planning areas. Therefore, the BLM assessed recent air quality conditions in the Bighorn Basin by examining data collected at the Cody and Basin monitors, supplemented by various monitors in neighboring planning areas, as summarized in Table 3-1. While there are limited ambient air quality monitoring data available in the study area, air quality is generally considered to be good, with no regions in the Planning Area designated as non-attainment for NAAQS or WAAQS. Since the Planning Area is in attainment of NAAQS, a General Conformity Determination is not required. Based on measurements in the area, visibility in the Planning Area is considered excellent. It should be noted that the monitoring data presented in this analysis were selected from the available list of sites in nearby

areas that would most closely match conditions in the Planning Area. For example, no data are presented for air quality monitoring sites located in the Upper Green River Basin (Sublette County), because, although some of these sites are closer to the Planning Area than other sites presented in the analysis, this area is located on the other side of the Wind River Range and has meteorological and emissions characteristics far different from those experienced in the Planning Area.

Table 3-3 is an overview of the applicable primary WAAQS and NAAQS and recent representative maximum pollutant concentrations measured in and at sites near the Planning Area. These representative concentrations can be compared with the applicable WAAQS and NAAQS to indicate the status of recent air quality conditions within the Planning Area relative to the standards.

Trends

This section describes recent trends in air quality in the Planning Area by examining data collected at the Cody PM_{10} monitor and nearby North Absaroka IMPROVE site, and as best as can be inferred criteria-pollutant (ozone), visibility, and deposition data collected at monitoring sites further outside the Bighorn Basin in adjacent areas. Because measurements of carbon monoxide (CO) are typically representative of local air quality and the Yellowstone monitor is the only site that measures CO near the Planning Area, the CO data presented in Table 3-3 may not be representative of conditions in the Planning Area.

Air Pollutant Concentrations

This section presents air quality data collected at the various monitors in and near the Planning Area (see Table 3-1) for PM_{10}, $PM_{2.5}$, O_3, SO_2, SO_4, NO_3, and NH_4. There are currently no measurements of HAPs within the Planning Area. Figure 3-2 shows annual peak 24-hour average PM_{10} concentrations at the Cody site for 2000 through 2012. Over this period, peak 24-hour average measurements of PM_{10} were well below the NAAQS (150 micrograms per cubic meter [$\mu g/m^3$]) and vary considerably from year to year. There is no real discernible trend during this period.

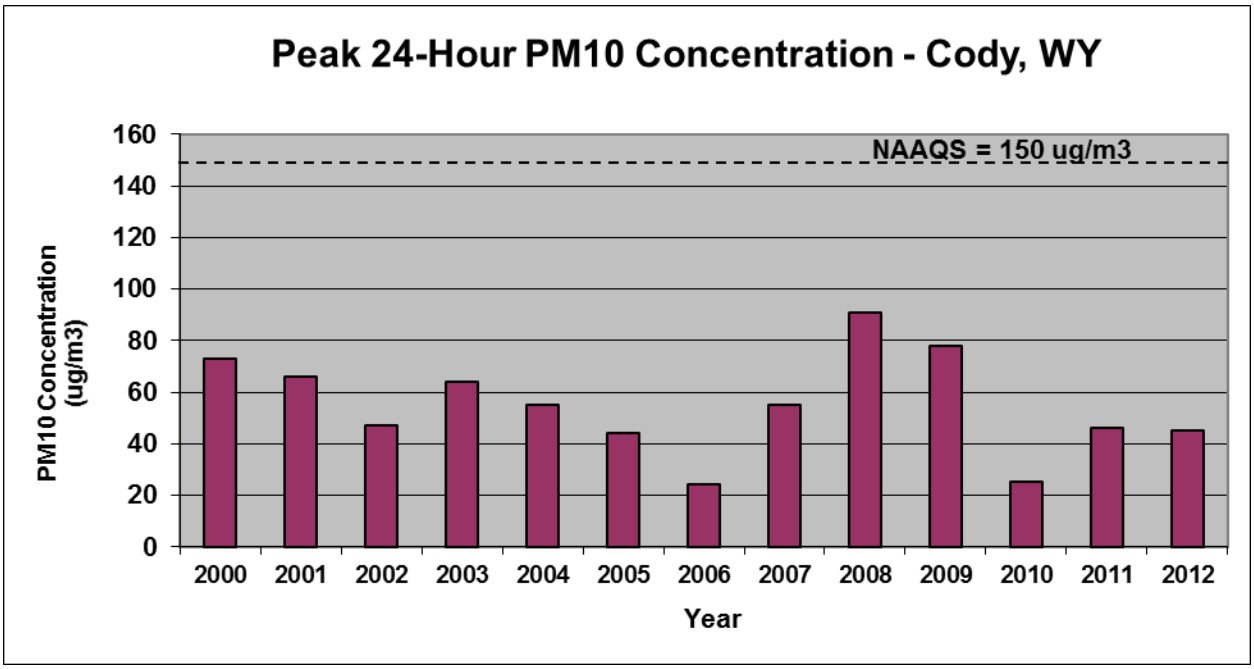
Table 3-3. Applicable National and State Primary Air Quality Standards for Criteria Pollutants and Current Representative Concentrations for the Planning Area

Pollutant	Averaging Time	NAAQS			WAAQS			Representative Concentrations		
		(ppm)	*(ppb)*	*(µg/m³)*	*(ppm)*	*(ppb)*	*(µg/m³)*	*(ppm)*	*(ppb)*	*(µg/m³)*
Carbon Monoxide	1 hour[1]	35	35,000	40,000	35	35,000	40,000	0.8	800	920
	8 hour[1]	9	9,000	10,000	9	9,000	10,000	0.3	300	345
Nitrogen Dioxide	1 hour [2]	0.10	100	188.7	N/A	N/A	N/A	0.011	11	21
	Annual[3] (Arithmetic Mean)	0.053	53	100	0.053	53	100	0.002	2.0	4
Ozone	8 hour[4]	0.075	75	147	0.075	75	147	0.056	56	110
PM_{10}	24 hour[5]	N/A	N/A	150	N/A	N/A	150	N/A	N/A	45
$PM_{2.5}$	24 hour[6]	N/A	N/A	35	N/A	N/A	65	N/A	N/A	11
	Annual[7]	N/A	N/A	15	N/A	N/A	15	N/A	N/A	2.4
Sulfur Dioxide[9]	1 hour[8]	0.075	75	195	N/A	N/A	N/A	0.033	33	86

[1]Not to be exceeded more than once per year. Data collected at Yellowstone National Park during 2012.
[2]To attain this standard, the 3-year average of the 98th percentile of 1-hour concentrations at each monitor within an area must not exceed 100 ppb. Thunder Basin data, 2010-2012.
[3]Thunder Basin annual average for 2012.
[4]To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 75 ppb. 3-year average of the fourth highest concentration for 2010-2012 for the Basin site.
[5]Not to be exceeded more than once per year on average over 3 years. Maximum 24-hour average for 2012 at Cody SLAMS site.
[6]To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations for 2010-2012 for the North Absaroka IMPROVE site.
[7]To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 12.0 µg/m³. 3-year average for 2010-2012 for the North Absaroka site.
[8]To attain this standard, the 3-year average of the 98th percentile of 1-hour concentrations at each monitor within an area must not exceed 75 ppb.
[9]The SO_2 value is from the Wyoming DEQ Casper monitor, located in Natrona County and is the 3-year average of the 98th percentile of 1-hour concentrations measured for 2011, 2012, and 2013. Although not located in the Bighorn Basin, this is the closest monitor with available recent data.

µg/m³	micrograms per cubic meter	ppb	parts per billion
N/A	Not Applicable	ppm	parts per million
NAAQS	National Ambient Air Quality Standards	SLAMS	State and Local Air Monitoring Site
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter	WAAQS	Wyoming Ambient Air Quality Standards
PM_{10}	particulate matter less than 10 microns in diameter	WARMS	Wyoming Air Resource Monitoring System

Figure 3-2. Peak 24-Hour Average Particulate Matter (PM_{10}) Concentrations (µg/m³) in Cody, Wyoming



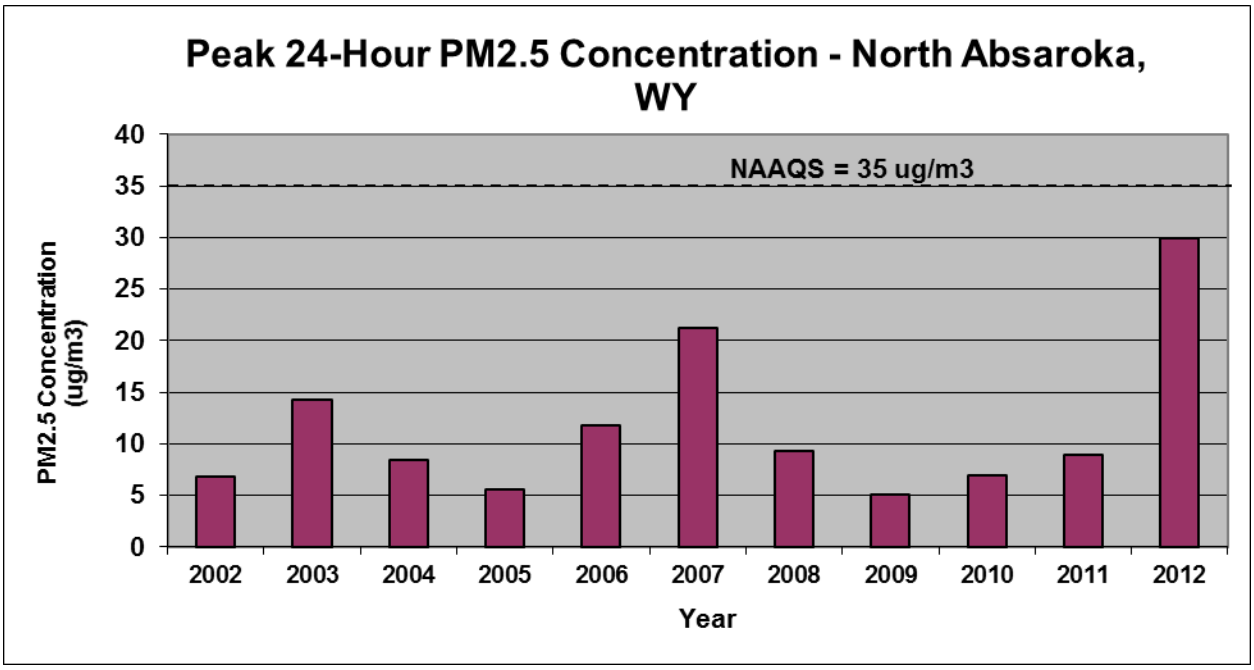
Source: EPA 2013

Note: The National Ambient Air Quality Standard for 24-hour average PM_{10} concentrations is 150 µg/m³.

µg/m³	micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
PM_{10}	particulate matter less than 10 microns in diameter

Figure 3-3 shows peak 24-hour average $PM_{2.5}$ data collected at the North Absaroka monitor for 2002 through 2012. With the exception of the peak value for 2012, the data indicate that the peak 24-hour average $PM_{2.5}$ concentration in the North Absaroka area was well below the NAAQS with no discernible trend during this period (IMPROVE 2013).

Figure 3-3. Peak 24-Hour Average Particulate Matter ($PM_{2.5}$) Concentrations (µg/m^3) for the North Absaroka Site



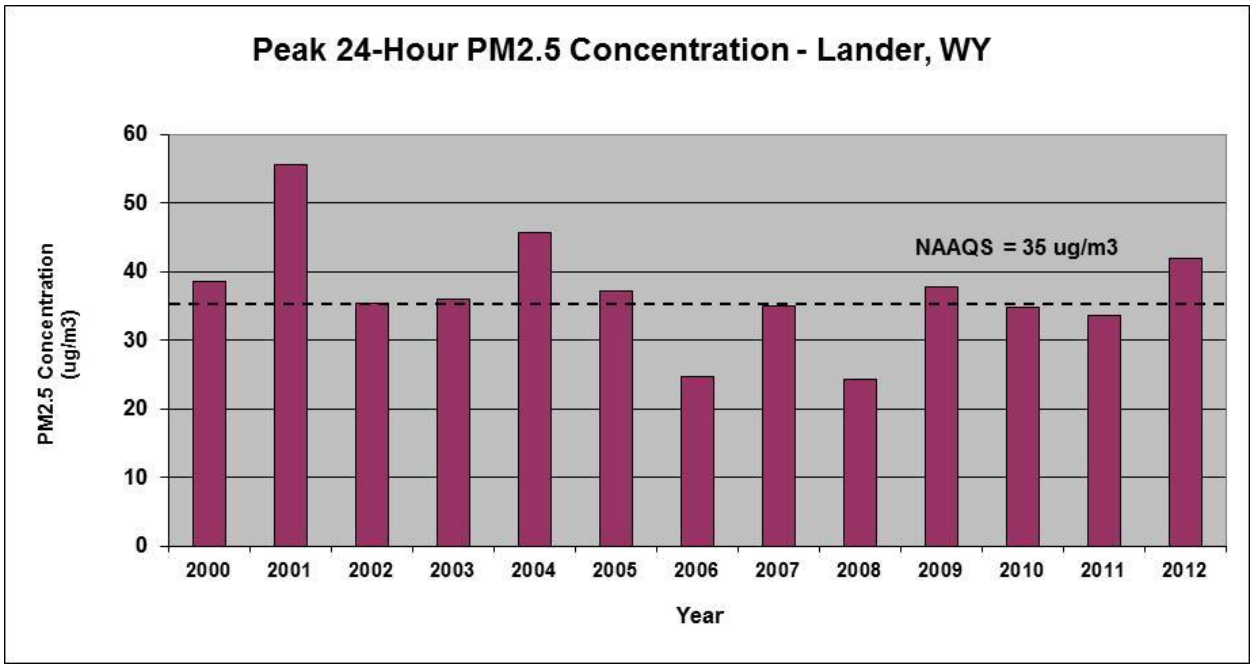
Sources: IMPROVE 2013; VIEWS 2013.

Note: The National Ambient Air Quality Standard for 24-hour average $PM_{2.5}$ concentrations is 35 µg/m^3.

µg/m^3	micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

In addition to measurements collected in the Planning Area at North Absaroka, the BLM also examined data collected in an area to the south near Lander, Wyoming. Figure 3-4 lists peak 24-hour average $PM_{2.5}$ data collected at the Lander monitor for 2000 through 2012. The data for the last four years (2009-2012) indicate that these concentrations are approaching the NAAQS, however, the comparison with the NAAQS is with the 3-year average of the 98th percentile value, not the peak value. These values are comparable and vary from year to year, with peak values of 37.8 µg/m^3 in 2009 and 41.8 µg/m^3 in 2012.

Figure 3-4. Peak 24-Hour Average Particulate Matter ($PM_{2.5}$) Concentrations (µg/m^3) for the Lander Site



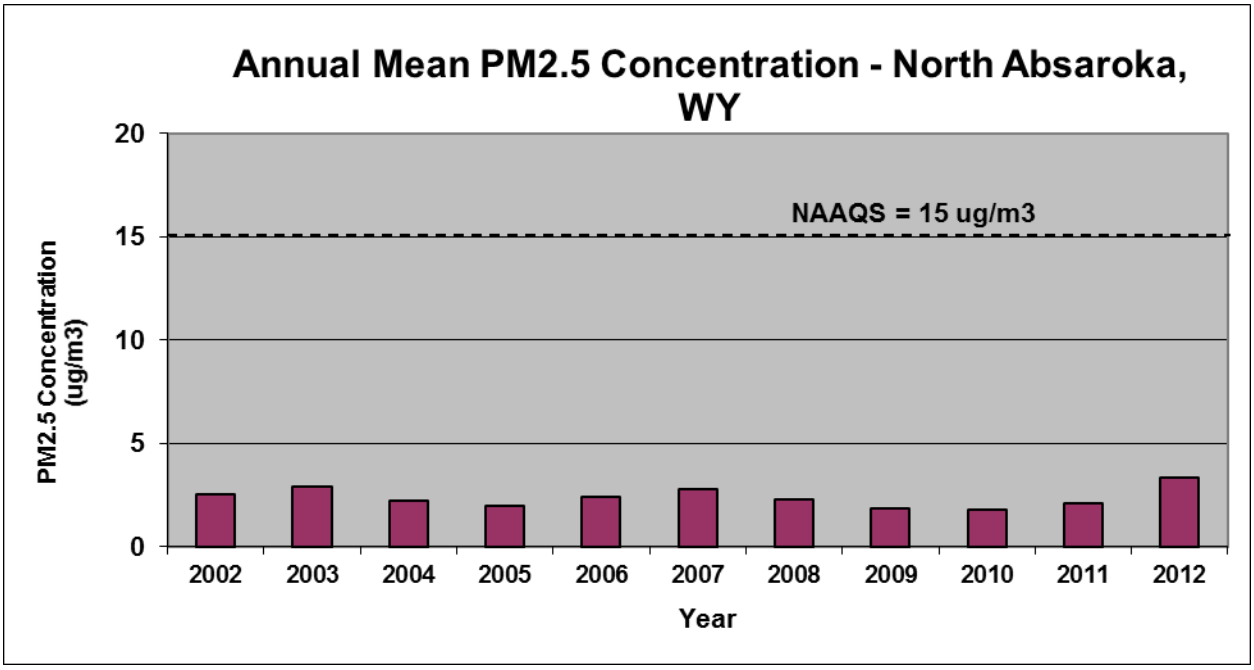
Source: EPA 2013

Note: The National Ambient Air Quality Standard for 24-hour average $PM_{2.5}$ concentrations is 35 µg/m^3.

µg/m^3	micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

Figure 3-5 shows annual average $PM_{2.5}$ data collected at the North Absaroka monitor for 2002 through 2012, and Figure 3-6 presents annual average $PM_{2.5}$ data collected at the Lander monitor for 2000 through 2012. The data indicate that annual average $PM_{2.5}$ concentrations in the Lander area are higher than those measured at North Absaroka, but are still well below the NAAQS. Trends are relatively flat during this period at both monitors.

Figure 3-5. Annual Average Particulate Matter ($PM_{2.5}$) Concentrations (µg/m^3) for the North Absaroka Site

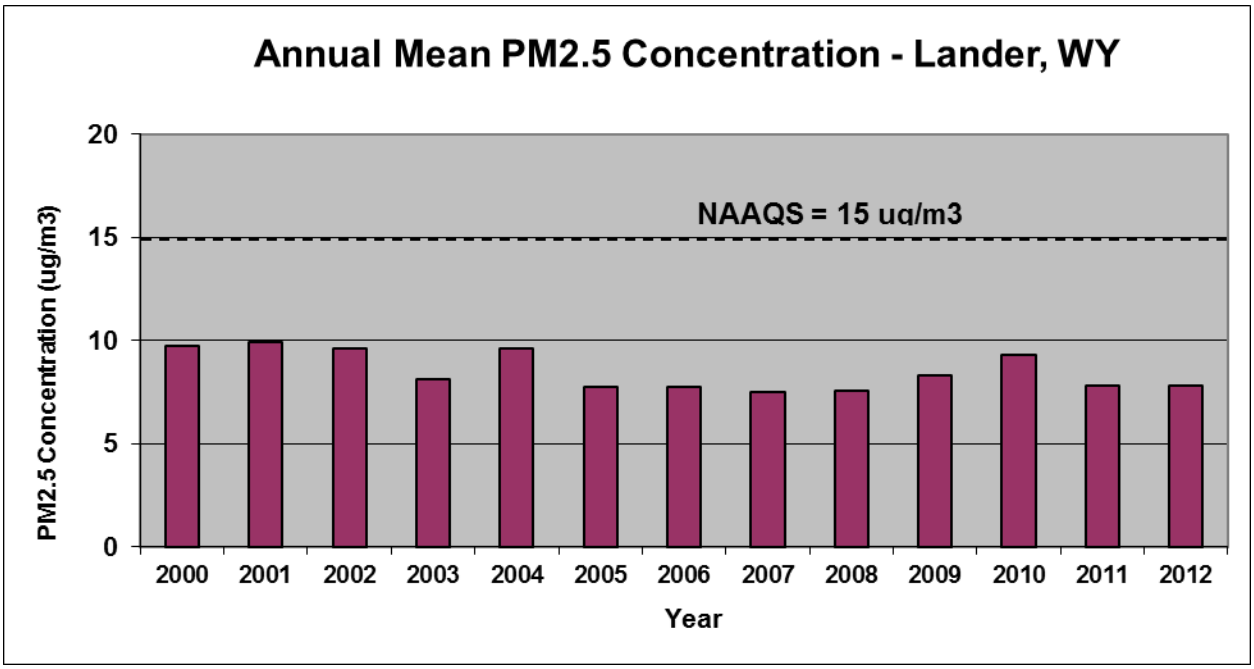


Sources: IMPROVE 2013; VIEWS 2013.

Note: The National Ambient Air Quality Standard for annual average $PM_{2.5}$ concentrations is 15 µg/m^3.

µg/m^3	micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

Figure 3-6. Annual Average Particulate Matter ($PM_{2.5}$) Concentrations (µg/m³) for the Lander Site



Source: EPA 2013

Note: The National Ambient Air Quality Standard for annual average $PM_{2.5}$ concentrations is 15 µg/m³.

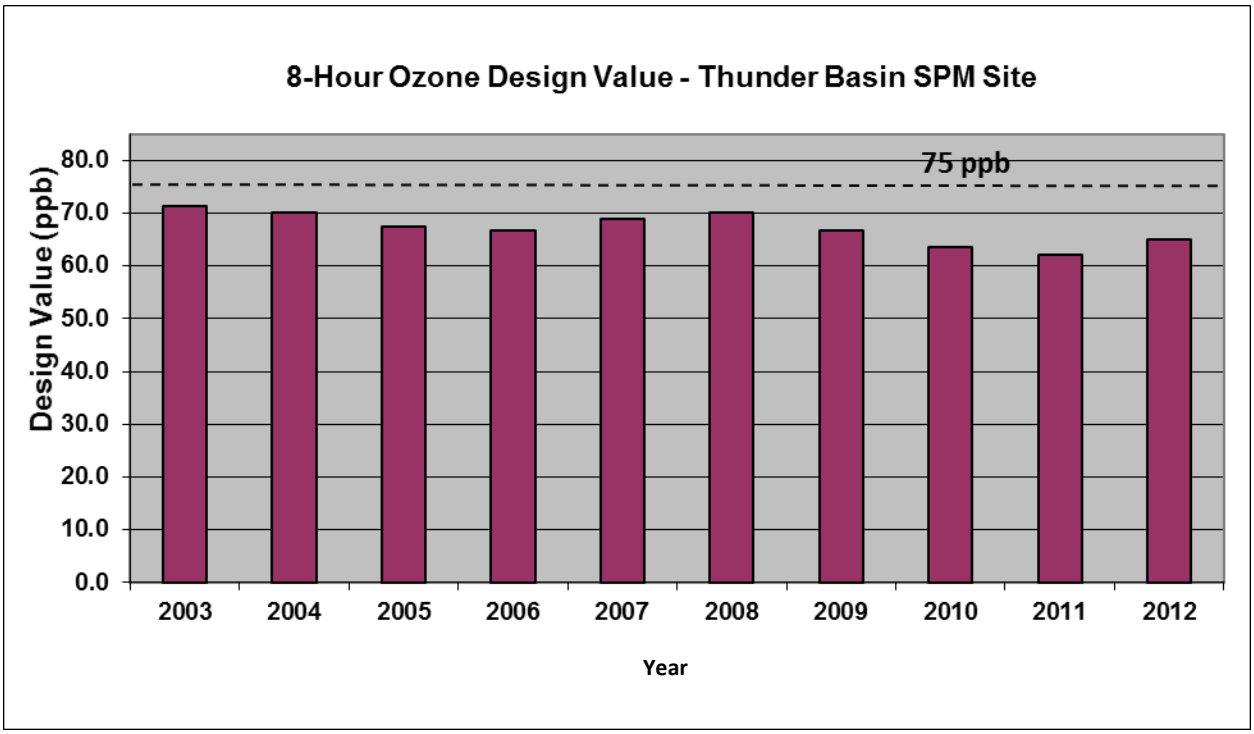
µg/m³	micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

Although a new WARMS monitoring site, referred to as the "Basin" site, began operating northwest of Worland in March 2010, there are currently no other ozone monitors in the Planning Area with three complete years of data that are required to calculate an ozone design value, which is calculated as the 3-year average of the fourth highest observed concentration and is used to assess compliance with the NAAQS. The 4th highest 8-hour average ozone concentrations measured at the Basin site in recent years are 55, 56, and 57 ppb, for 2010, 2011, and 2012, respectively, for a calculated design value of 56 ppb, which is well below the current 8-hour ozone NAAQS.

For a longer-term evaluation of observed ozone near the Planning Area, Figure 3-7 lists the calculated design values for the Thunder Basin site calculated from data collected during the period for 2001 through 2012. The most recent design value for the Thunder Basin site for 2010 through 2012 is 65 parts per billion (ppb), which is below the current 8-hour ozone NAAQS of 75 ppb. (Currently EPA is evaluating the level of the standard and may reduce this value to 70 ppb or lower. If the 8-hour ozone NAAQS is reduced to 70 ppb, it is possible that areas with design values greater than the new standard (e.g., those located in the adjacent Buffalo and other planning areas in Wyoming) would be designated ozone nonattainment areas.) Although the data for Thunder Basin vary from year to year during this period, there is no discernible trend in the 8-hour ozone design values at this site. However, the Thunder Basin site also located in the adjacent Buffalo planning area on the other side of the Big Horn Mountain range and may not be representative of long-term ozone air quality trends in the Bighorn Basin. This is due to the influence of local sources of precursor emissions, differing weather conditions,

terrain, and other factors on secondary ozone production and transport in and throughout the Bighorn Basin.

Figure 3-7. 8-Hour Average Ozone Design Values for the Thunder Basin Special Purpose Monitoring Site



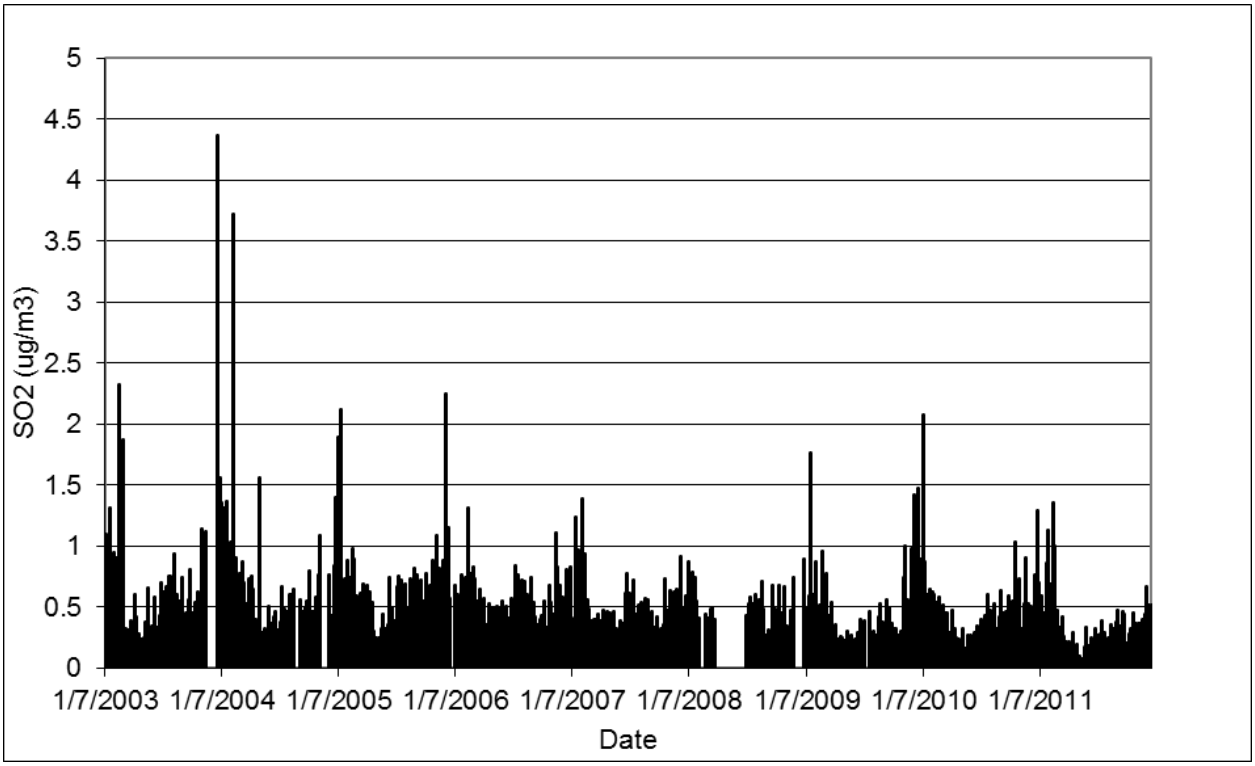
Source: Wyoming DEQ 2013b

Note: The National Ambient Air Quality Standard for 8-hour average ozone concentrations is 75 ppb.

ppb parts per billion

Although not in the Planning Area, the nearby Buffalo monitoring site is part of the WARMS network and provides a summary of observed concentrations of sulfur and nitrogen compounds in adjacent areas. Figures 3-8, 3-9, 3-10, and 3-11 show weekly average concentrations of SO_2, SO_4, NO_3, and NH_4 respectively, for the Buffalo site for 2003 through 2011. There are data missing for a number of weeks throughout this period, especially in 2008. The data show weekly and seasonal variations in these compounds, with no real discernible long-term trends over the period.

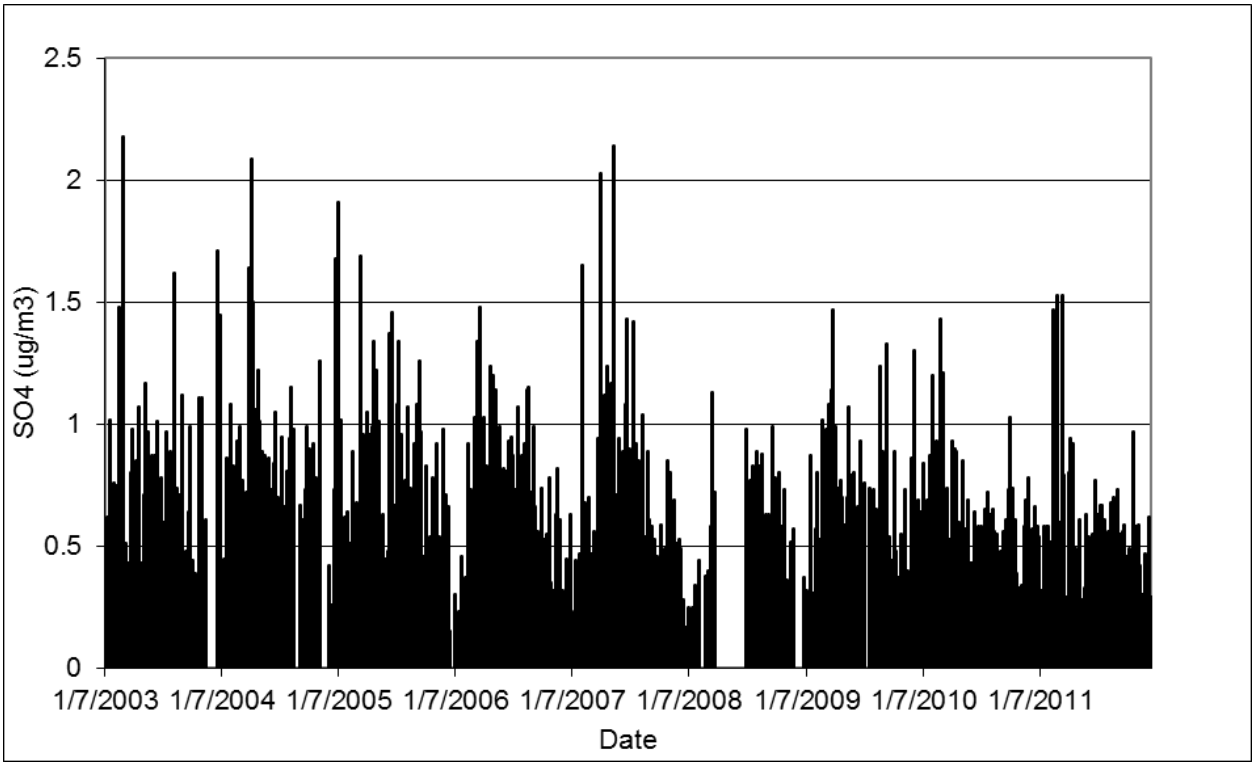
Figure 3-8. Weekly SO_2 Concentrations (µg/m³) – Buffalo WARMS Monitor



Source: WARMS 2013

µg/m³	micrograms per cubic meter
SO_2	sulfur dioxide
WARMS	Wyoming Air Resource Monitoring System

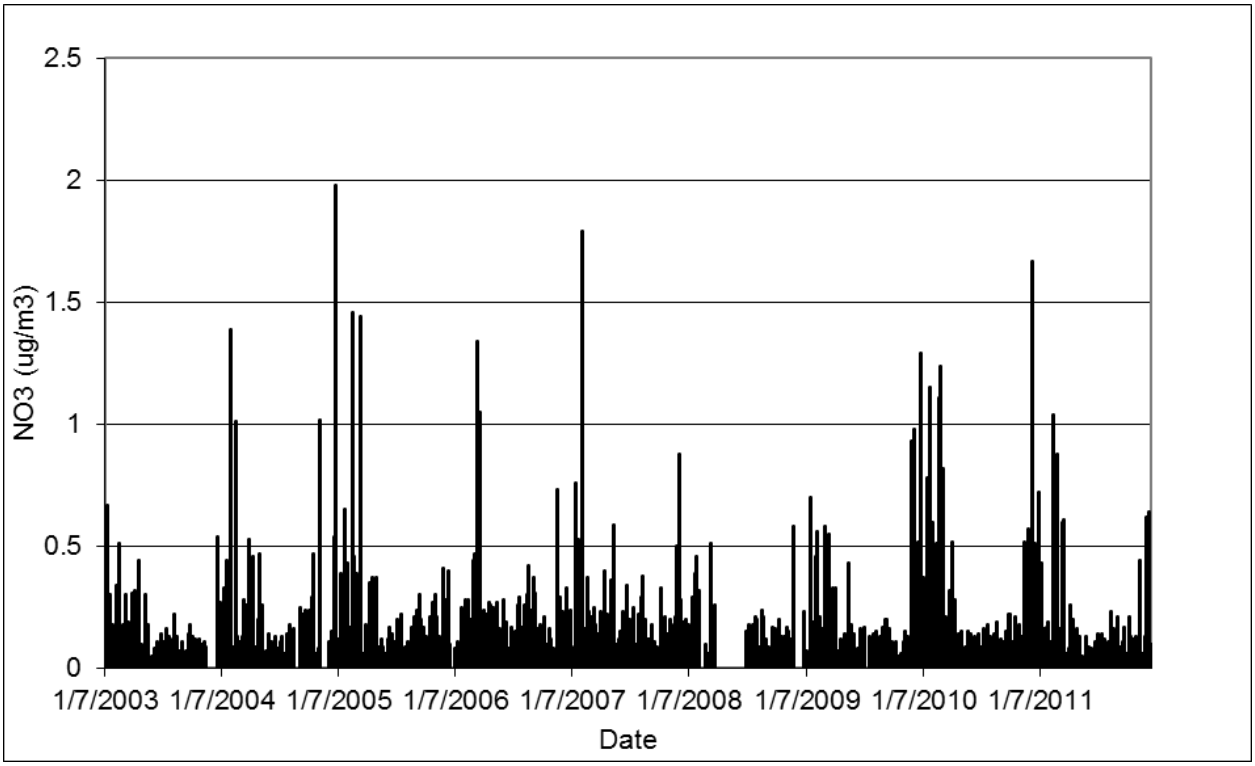
Figure 3-9. Weekly SO_4 Concentrations (µg/m³) – Buffalo WARMS Monitor



Source: WARMS 2013

µg/m³	micrograms per cubic meter
SO_4	sulfate
WARMS	Wyoming Air Resource Monitoring System

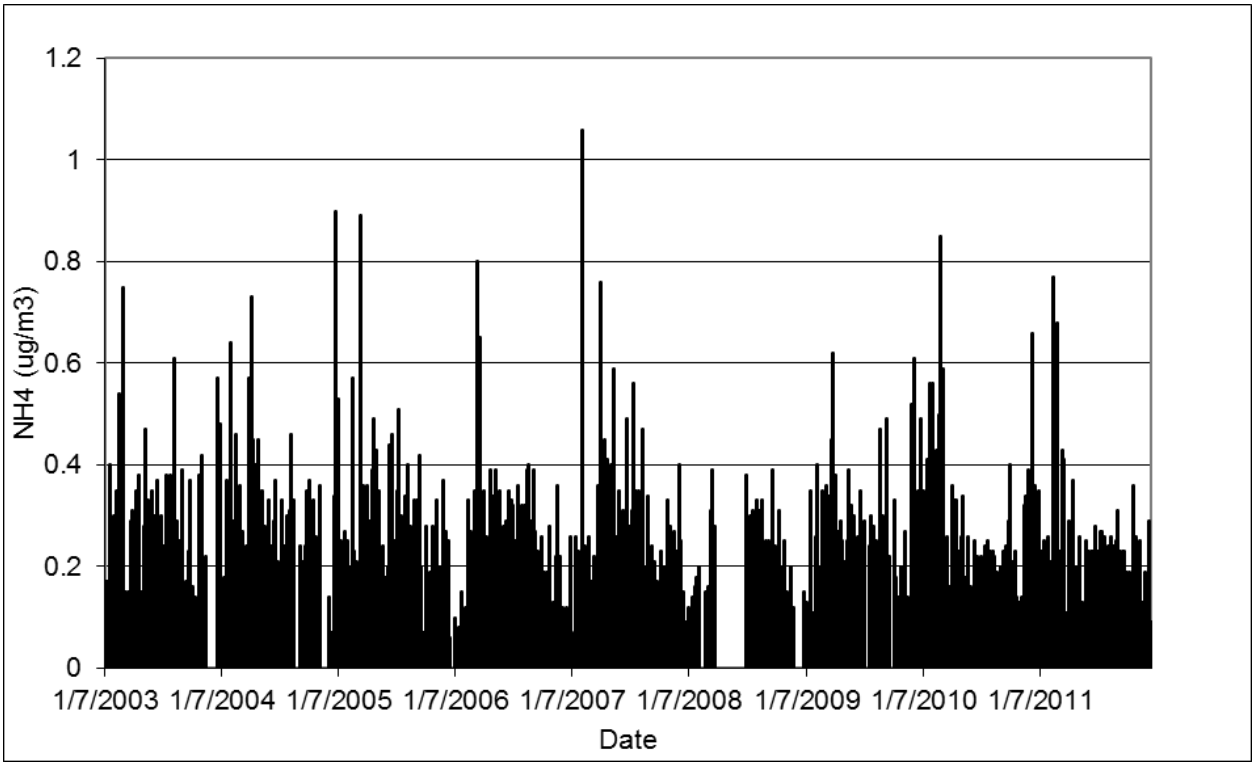
Figure 3-10. Weekly NO_3 Concentrations (µg/m³) – Buffalo WARMS Monitor



Source: WARMS 2013

µg/m³	micrograms per cubic meter
NO_3	nitrate
WARMS	Wyoming Air Resource Monitoring System

Figure 3-11. Weekly NH_4 Concentrations (µg/m³) – Buffalo WARMS Monitor



Source: WARMS 2013

µg/m³	micrograms per cubic meter
NH_4	ammonium
WARMS	Wyoming Air Resource Monitoring System

Visibility

There are several National Parks, recreation areas, wilderness areas, and National Forests in or near the Planning Area. As depicted on Figure 3-1, Table 3-4 lists areas designated as Class I or Class II.

Table 3-4. Class I and Class II Areas In or Near the Planning Area

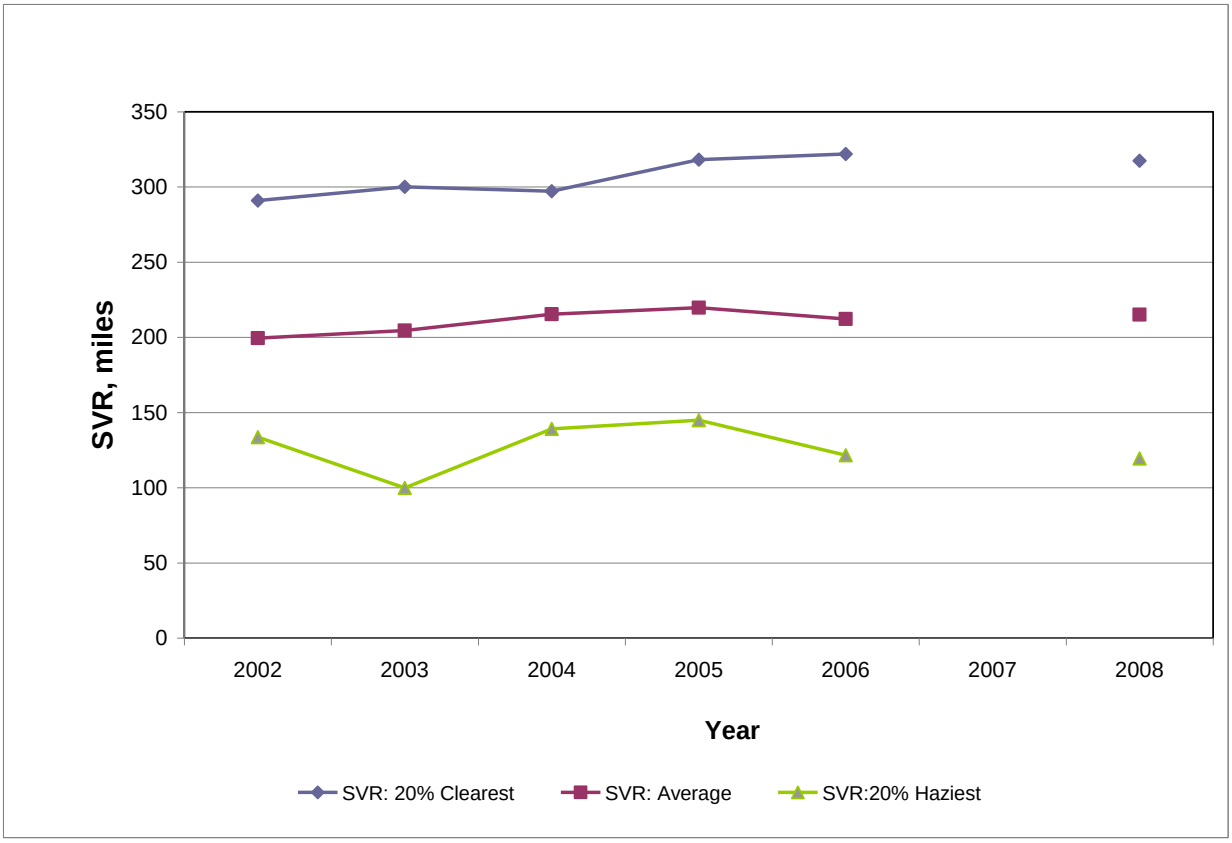
Area Type	Area Name	Closest Distance to the Planning Area (miles)	Direction from the Planning Area	Clean Air Act Status of the Area
National Park	Wind Cave National Park	200	East	Class I
	Yellowstone National Park	Adjacent	West	Class I
Recreation Area	Bighorn Canyon National Recreation Area	In	-	Class II
Wilderness Area	Cloud Peak Wilderness Area	In	-	Class II
	North Absaroka Wilderness Area	In	-	Class I
	Washakie Wilderness Area	In	-	Class I
	Fitzpatrick Wilderness Area	30	Southwest	Class I
	Popo Agie Wilderness Area	50	South	Class II
	Bridger Wilderness Area	35	Southwest	Class I
	Teton Wilderness Area	Adjacent	Southeast	Class II
National Forest	Bighorn National Forest	In	-	Class II
	Thunder Basin National Grassland	75	East	Class II

Source: NPS 2006

As noted above, estimates of visibility in the Planning Area are primarily derived from air quality and meteorological measurements taken at the North Absaroka IMPROVE site. To supplement these measurements, the BLM used recent data collected at the nearby Cloud Peak IMPROVE monitor to assess regional visibility conditions.

Figure 3-12 shows visibility estimates for the North Absaroka site for 2002 through 2008. There are no more recent data available for this monitor. Although missing for 2007, there are no real trends during this limited period. Figure 3-13 shows visibility data for the Cloud Peak IMPROVE site for 2003 through 2010. The data for the Cloud Peak site are quite consistent with the North Absaroka site, and reflect a slight trend of improved visibility for the 2007 to 2010 period.

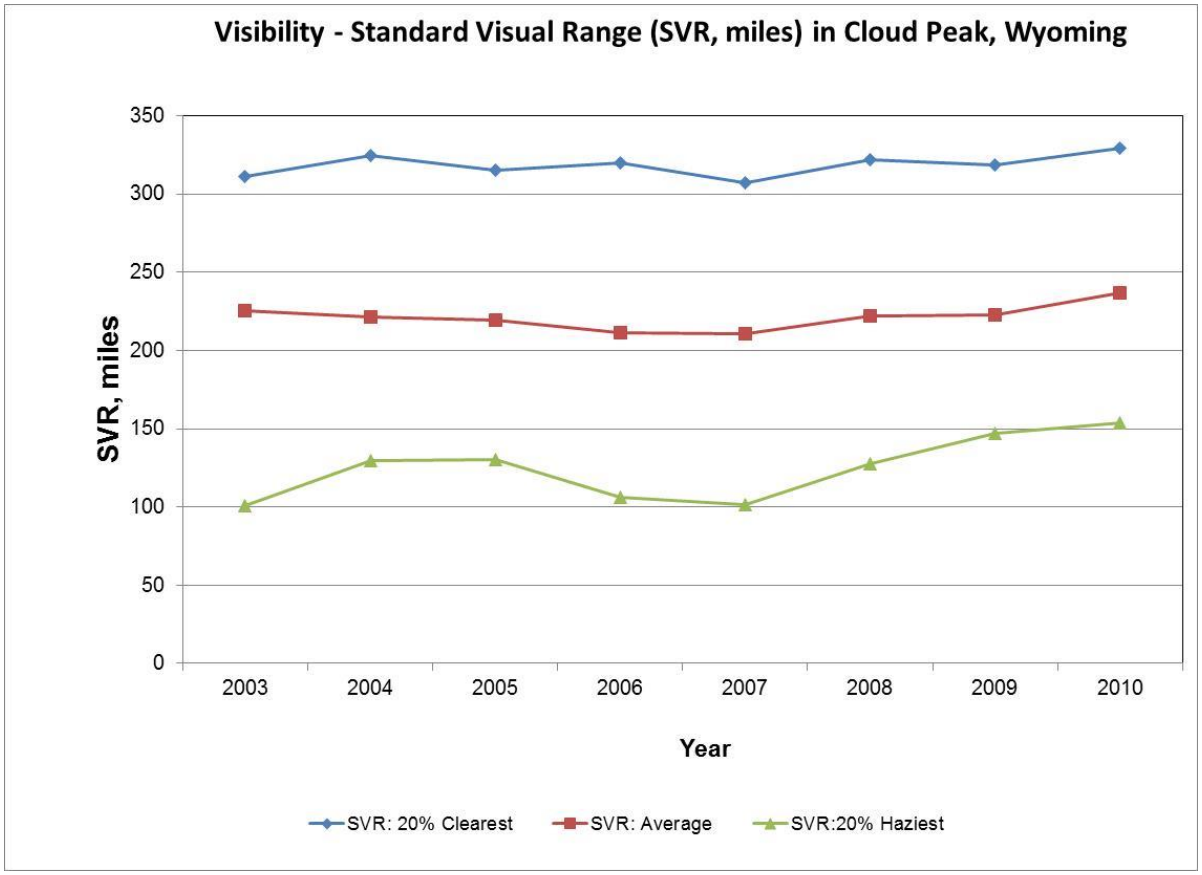
Figure 3-12. Visibility – Standard Visual Range (SVR, miles) for the North Absaroka, Wyoming, IMPROVE Site



Source: IMPROVE 2013

IMPROVE Interagency Monitoring of Protected Visual Environments
SVR standard visual range

Figure 3-13. Visibility – Standard Visual Range (SVR, miles) for the Cloud Peak, Wyoming, IMPROVE Site



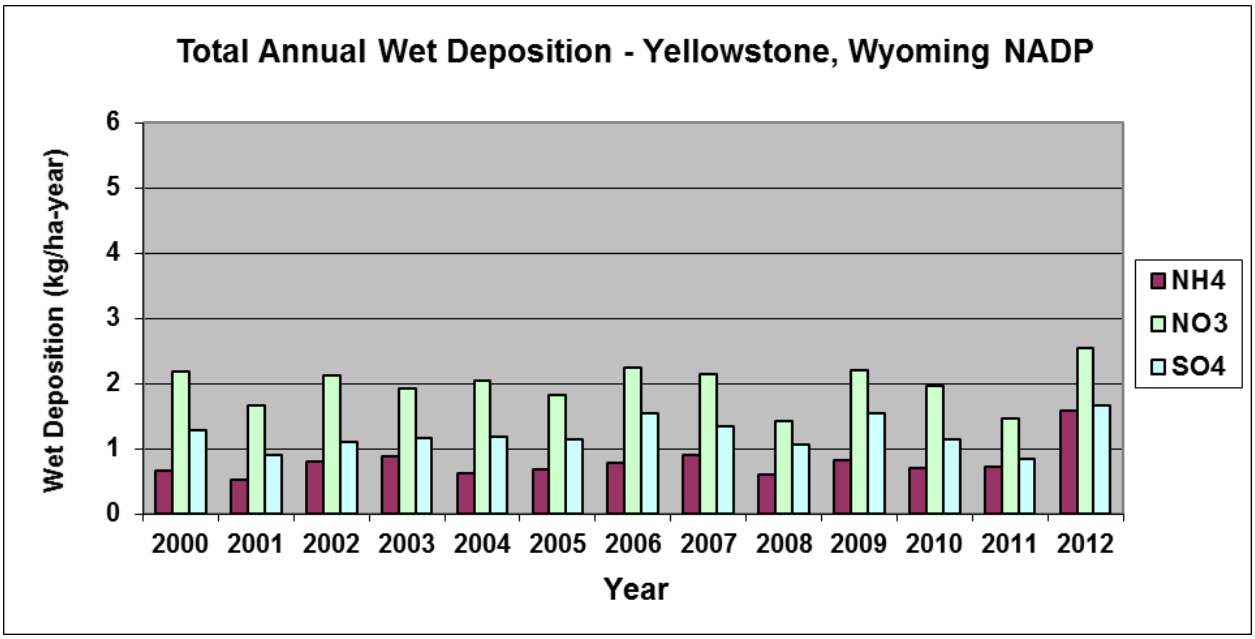
Source: IMPROVE 2013

IMPROVE Interagency Monitoring of Protected Visual Environments
SVR standard visual range

Atmospheric Deposition

There are no NADP monitors located within the Planning Area and no deposition data are available from the recently upgraded Basin CASTNet/WARMS monitor located within the Planning Area. However, wet deposition measurements are available for the nearby Yellowstone, Sinks Canyon, and South Pass City NADP monitors. Figure 3-14 shows total annual wet deposition for NH_4, NO_3, and SO_4 for 2000 through 2012 for Yellowstone. Figure 3-15 and Figure 3-16 show similar wet deposition information for the Sinks Canyon and South Pass sites, respectively. Wet deposition values are slightly higher at these two sites compared to Yellowstone, but the data indicate a general downward trend in deposition at these sites during the 2005 to 2012 period. While there was a spike in the wet nitrogen deposition for 2010 at the South Pass site, this could be considered a localized, outlier event. For all years examined and for all sites, annual wet nitrogen deposition exceeds the LOC of 1.5 kg per ha per year, with the largest values measured at the South Pass site. For annual wet sulfur deposition, the LOC of 3 kg per ha per year is exceeded for only a few years at the South Pass site.

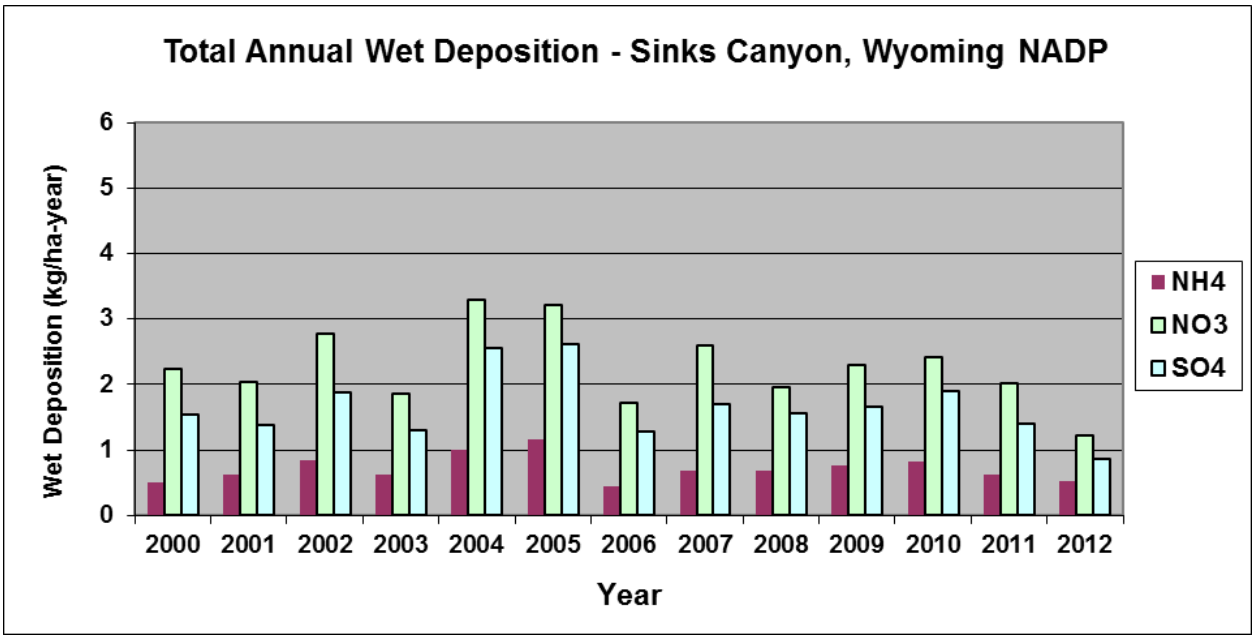
Figure 3-14. Total Annual Wet Deposition (kilograms per hectare per year) Yellowstone Park, Wyoming NADP Site



Source: NADP 2013

ha	hectare
kg	kilogram
NADP	National Atmospheric Deposition Program
NH_4	ammonium
NO_3	nitrate
SO_4	sulfate

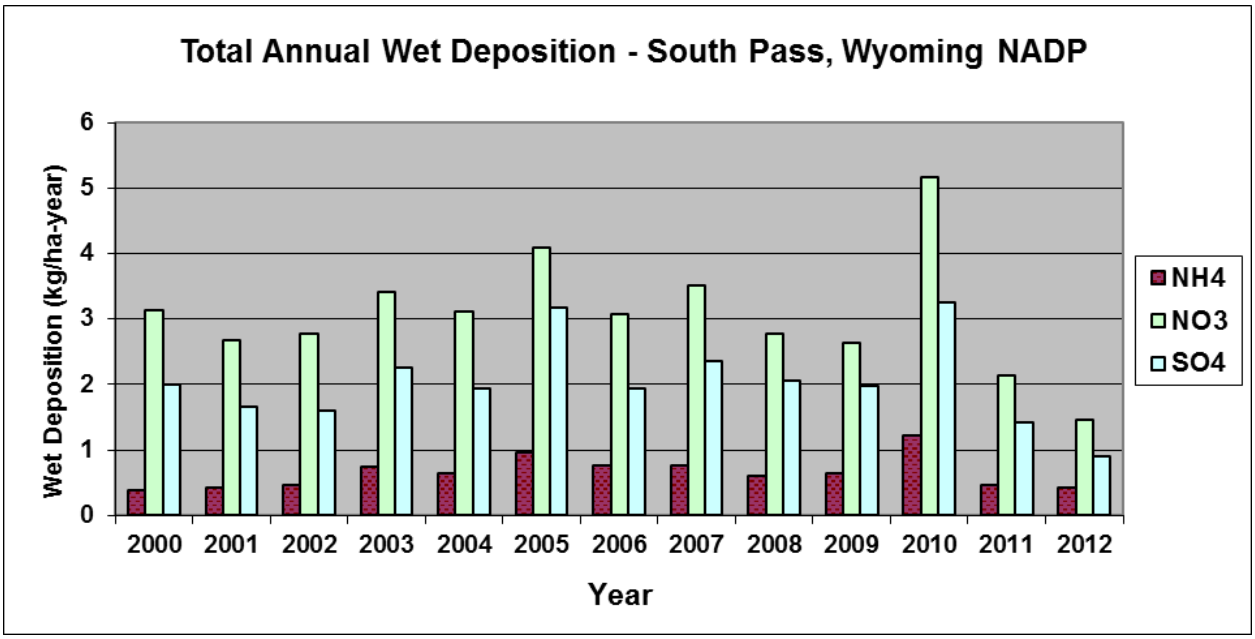
Figure 3-15 Total Annual Wet Deposition (kilograms per hectare per year) Sinks Canyon, Wyoming NADP Site



Source: NADP 2013

ha	hectare
kg	kilogram
NADP	National Acid Deposition Program
NH_4	ammonium
NO_3	nitrate
SO_4	sulfate

Figure 3-16. Total Annual Wet Deposition (kilograms per hectare per year) South Pass City, Wyoming NADP Site



Source: NADP 2013

ha	hectare
kg	kilogram
NADP	National Acid Deposition Program
NH_4	ammonium
NO_3	nitrate
SO_4	sulfate

Hazardous Air Pollutants, Other Criteria Pollutants, and Greenhouse Gases

Existing sources of HAPs, criteria pollutants (other than those discussed above), and GHGs in the Planning Area include fossil fuel combustion that emits HAPs; oil, natural gas, and coal development operations that emit VOCs; NO_X; and hydrogen sulfide (H_2S). In addition, large fires are a source of HAPs emissions. There are no measurements of HAPs or other criteria pollutants (e.g., NOx and VOC) available for analysis within the Planning Area. The lack of historical observations, and the growth in resource development and accompanying increases in emissions from these types of sources will depend on a number of external factors that make it difficult to estimate actual long-term trends in these pollutants.

Summary

Available air quality data for a number of criteria pollutants that were examined at various monitors in and near the Planning Area do not show any significant upward or downward trends over the various periods of record, except for peak 24-hour average $PM_{2.5}$ at the North Absaroka site. Concentrations of peak 24-hour average $PM_{2.5}$ at this site are low, vary from year to year, and show an upward trend during the last four years of the 11-year period examined. The annual average $PM_{2.5}$ data for North Absaroka show low concentrations well within the NAAQS and no discernible long-term trends. The peak 24-hour average $PM_{2.5}$ data for the Lander site show a relatively flat trend during the last 4 years of record (2009 through 2012). The newly installed Basin WARMS/CASTNet monitor has a calculated 8-

hour average ozone design value of 56 ppb, which is well below the NAAQS. No deposition or SO_2 data were available from the Basin monitor for inclusion in this analysis.

Although statistical trends were not explicitly calculated for SO_2, SO_4, NO_3, and NH_4, the data do not indicate any major trends for the 11-year period examined at the Buffalo site, which is adjacent to the Bighorn Basin. As noted above, these data may not be indicative of air quality within the Bighorn Basin, but were presented to illustrate air quality conditions in an adjacent area. The visibility data collected at the North Absaroka and Cloud Peak sites show very good to excellent visibility, even for the 20 percent haziest days, with a very slight degradation observed at the Cloud Peak monitor during the periods of record examined. Wet-deposition data for NH_4, NO_3, and SO_4 for the Yellowstone, Sinks Canyon, and South Pass City sites also show no distinct trend in deposition over the 13-year period of record (2000 through 2012) examined in this analysis.

Management Challenges

Due to limited data, accurately characterizing air quality in the Planning Area is a challenge. However, limited monitoring at two sites in the Planning Area and data collected at monitors in adjacent areas do reflect good to excellent air quality and visibility conditions. Continued maintenance of the federal and state air quality standards could be an issue without a complete understanding of existing air quality. As additional resource development scenarios are considered for the area, it will be important to evaluate the effects that emissions from development sources would have on criteria pollutants, visibility, and atmospheric deposition levels. The BLM will work cooperatively with the Wyoming DEQ Air Quality Division and the EPA and other federal agencies to address these issues.

Other management challenges include identifying the full spectrum of air quality issues in the Bighorn Basin and developing effective management actions aimed at maintaining compliance with standards and improving air quality.

3.1.2 Geologic Resources

Physiographic Regions/Regional Context

The Bighorn Basin is an intermontane basin in the Middle Rocky Mountain Foreland geologic province. It is an asymmetric, northwest-trending topographical and structural basin with an elliptical shape, bounded on the northeast by the Pryor Mountains, on the east by the Big Horn Mountains, on the south by the Owl Creek, Bridger and Washakie Ranges, on the northwest by the Beartooth Mountains, and open to the north into Montana. The basin is also bounded on the west by volcanic rocks of the Absaroka Mountains which were erupted and deposited atop older Laramide uplifts. The north end of the Bighorn Basin is considered to terminate structurally along a low-lying folded and faulted zone known as the Nye-Bowler lineament in Montana (Thomas 1965).

The topography of the Planning Area varies from rolling plains, flat mesas, and badlands to alluvial valleys, benches, foothills, and mountains (BLM 1993). Many pronounced anticlinal and synclinal folds, some of which have considerable structural relief (Pierce and Andrews 1941) occupy the foothills or "flank" areas of the basin. Riparian corridors, badlands, and benches/upland topography dominate the central basin. The paragraphs that follow further address geologic structure in the Bighorn Basin. See the *Solid Mineral Occurrence and Development Potential Report* for further discussion on the geology of the Bighorn Basin (BLM 2009d).

Stratigraphy and Economic Geology

Figure 3-17 provides a generalized stratigraphic and lithologic section for the Bighorn Basin; Map 96 displays a geologic map of the Planning Area.

Stratigraphically, rocks of all the geologic periods, with the exception of the Silurian Period, are represented in the numerous formations found in the Planning Area. The sedimentary rocks were deposited during the repeated advances and retreats of ancient seas and epicontinental seaways (such as the Sundance Seaway and the Cretaceous Seaway) that covered the Planning Area, and during other terrestrial depositional environments, including, fluvial, aeolian, and lacustrine.

Sedimentary rocks in the Planning Area range in age from Cambrian to Holocene, have an aggregate thickness of more than 33,000 feet, and overlie Precambrian metamorphic and granitic basement rock. Within the Bighorn Basin, younger sedimentary formations tend to be exposed toward the center of the basin, while progressively older formations crop out generally toward the eastern, southern, and western edges of the basin. Sedimentary rocks are folded and faulted as a result of uplifts of the mountains that rim the basin.

The geology of the basin is conducive to the accumulation of hydrocarbons (also known as fossil fuels) given the presence of sedimentary formations that act as source rocks, reservoir rocks, and impermeable caps to some of the reservoir rocks. See the *Reasonable Foreseeable Development Scenario (RFD) for Oil and Gas* for a discussion on oil and gas development potential in the Planning Area (BLM 2014a).

Some formations contain coal seams of varying thicknesses and grades. Other formations contain the remains of ancient volcanic ash deposits that were chemically altered into beds of montmorillonite and beidelite clay known as bentonite. Some formations are a source of dimension stone (material quarried as block or slabs that also meets certain size and shape specifications) and construction stone. There are thick sand and gravel deposits along rivers and streams throughout the basin.

Historical and Structural Geology

The Bighorn Basin formed as a result of the Laramide Orogeny, a compressional mountain-building and basin-forming event, which took place from late Cretaceous time (about 80 million years ago [MYA]) to middle Eocene time (about 45 MYA) (Downs 1952). Large blocks of Precambrian-age rock were displaced upward, generally along reverse or ramp faults of varying dips (Fanshawe 1971), with resultant folding and faulting of the overlying sedimentary rock layers. During this time, the Big Horn, Owl Creek, Pryor, Beartooth, and Washakie Ranges were uplifted, as were numerous smaller anticlinal structures along the inner flank or margin of the basin. The central portion of the Bighorn Basin was relatively undeformed during the Laramide Orogeny, and received sediment eroded from surrounding uplifts.

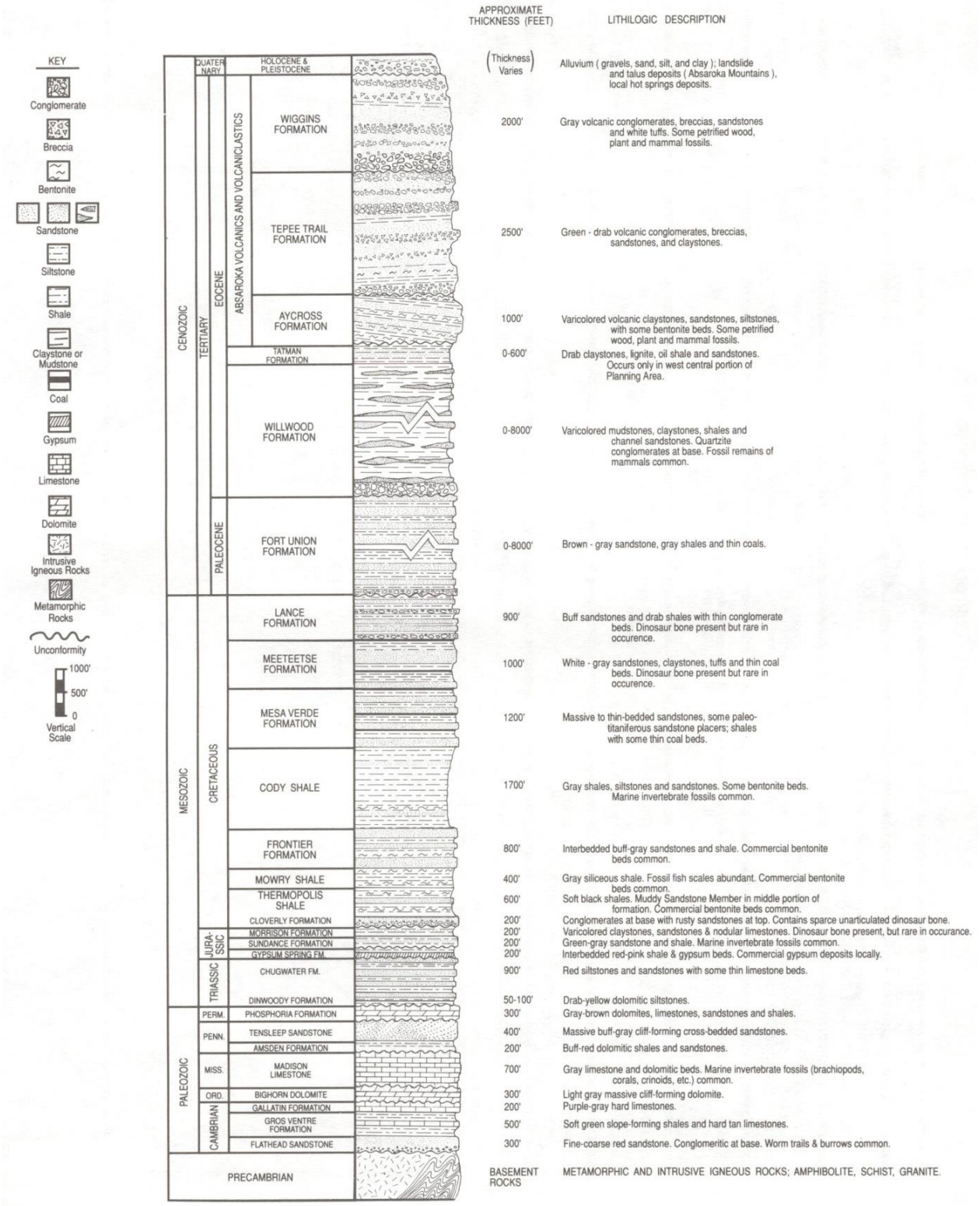
Approximately 10 to 12 MYA, a period of broad regional uplift and extension (epeirogeny) began in Miocene time that has continued into the present (Fanshawe 1971). This broad general uplift triggered increased erosional activities, leading to excavation of deep canyons, (i.e., Cottonwood Canyon, Wind River Canyon, Clarks Fork Canyon, Sheep Mountain Canyon, and Devil's Canyon), and removal of thousands of feet of basin sediment via large rivers and their tributaries. Streams such as the Shoshone River, the Bighorn River, Porcupine Creek, and Cottonwood Creek were rejuvenated during this time of uplift, and began to incise deep canyons into the underlying Paleozoic shales, limestones, and dolomites.

During the Pleistocene Epoch (approximately 2 MYA to 15,000 years ago), the mountain uplifts experienced several episodes of alpine glaciation. Alpine glaciation is responsible for numerous U-shaped glacial valleys, glacial lakes, terminal and lateral moraines, and other glacially derived landforms seen today along the Beartooth front, in the Absaroka Mountains, and in the Big Horn Mountains.

Current Geological Conditions

Currently, the Bighorn Basin is generally experiencing an erosional phase, with deposition of sediment occurring locally in rivers, streams, and lakes, and reservoirs. Erosion of sediment by rivers, streams, wind, gravity, and ice far exceeds sediment deposition in the basin. The consolidated rocks and unconsolidated sediments in the Planning Area are constantly affected by the forces of weathering and erosion. Rocks weather through mechanical processes, chemical processes, or both. Water, wind, ice, and gravity are the principal weathering agents. The mild acidity of rain or snow causes chemical erosion and tends to dissolve carbonate rocks. Water reacts with the calcium carbonate in limestone to form carbonic acid, which dissolves limestone even more aggressively than water alone.

Figure 3-17. Generalized Stratigraphic and Lithologic Section of the Bighorn Basin



Source: BLM 1993

Water weathers rocks by infiltrating pore spaces or fractures in rock, freezing, and then thawing, thereby acting to wedge the rock apart. Water flowing downslope transports sediment of various sizes down gradient. Pebbles and cobbles in channel and terrace deposits along streams and rivers in the Planning Area reveal their various sources in the varying lithologies seen in the deposits.

Bentonite, gypsum, and sand and gravel mining alter the existing geologic resources in the Planning Area, because these activities remove commercial quantities of minerals from the geologic formations. Other surface disturbances change the condition of existing geological resources by disturbing or loosening soil or rock at the surface.

The degree and direction of change to geology due to the weathering process would be imperceptible over the life of a land use plan. Typically, mining activities would tend to change the character of the surface over the short term, but over the long run, disturbed areas would be reclaimed and returned to the extent possible to the preexisting slope and vegetative cover.

3.1.3 Soil

Soils in the Planning Area are diverse and highly variable. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, position on the landscape, elevation, aspect, and climatic variables such as precipitation and temperature. The plant communities supported by such a wide diversity of soils are equally diverse, ranging from sparsely vegetated desert saltbush and sagebrush-bunchgrass communities to forests and alpine meadows. More than 60 ecological sites have been identified in the Planning Area. Low annual precipitation, salinity, alkalinity, and shallow depths have the greatest effect on soil productivity and the plant communities they support.

The Washakie County soil survey is the only published soil survey for the Planning Area (NRCS 1983). Soil data for Hot Springs, Big Horn, and Park counties have been compiled from earlier inventory efforts and are available in digital format. A soil database allows soil data to be applied for use and suitability interpretations. This database is adequate for most soil interpretations.

Soil Characteristics and Regional Context

Soils in the Planning Area formed from a wide variety of geologic material. Variation in parent material, along with variable climate, topography, and vegetation, has resulted in soils with diverse characteristics and textures.

Soils commonly found in the Planning Area include soils with moderately fine to fine textures (clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, clay) that formed over shale or were influenced by shale parent material. Soils in the Planning Area that formed over sandstone or were influenced by sandstone parent material generally have medium to moderately coarse textures (sandy loam, fine sandy loam, very fine sandy loam, loam). Coarse-textured soils (loamy sand, sand) in the Planning Area are generally associated with windblown soils derived from sandstone parent material. The soils characterized by reddish hues often are referred to as red bed soils. The formation of these highly productive soils was strongly influenced from the red sandstone common to the Chugwater formation. These soils have high gypsum content and generally have medium textures (very fine sandy loam, loam fine sandy loam). As a result, they are highly susceptible to erosion following surface disturbance or vegetation reduction.

Biological soil crusts, often referred to as cryptobiotic, cryptogamic, and microbial soil crusts, are found on all soil types throughout the Planning Area. Biological soil crusts are an intimate association between soil particles and cyanobacteria, mosses, lichens, microfungi, and algae (Rosentreter et al. 2007). The

presence of biological soil crusts increases soil stability and the soil's resistance to wind and water erosion, and by forming stable soil aggregates, allows for increased water infiltration. They also add carbon to the soil surface, convert atmospheric nitrogen to bio-available nitrogen, and increase bio-available phosphorus. The distribution and extent of biological soil crusts have not been well documented in the Planning Area largely due to the age of the soil survey data. Rangeland health surveys are documenting the presence of biological crusts using the 17 indicators of rangeland health. As the soil survey dataset is updated, key data collected will relate to biological crusts.

The Planning Area lies within two MLRAs: the Northern Intermountain Desertic Basins – 32 (5- to 9-inch and 10- to 14-inch precipitation zones) and Central Rocky Mountains – 43B (15- to 19-inch and 20+-inch precipitation zones) (USDA 2008). The following paragraphs provide an overview of Planning Area soils by MLRA.

Northern Intermountain Desertic Basins

The dominant soil orders in the Northern Intermountain Desertic Basins are Entisols and Aridisols. These soils have a mesic temperature regime, an aridic soil moisture regime, and mixed mineralogy. They generally are shallow to very deep, well drained, and loamy and consist of Torriorthents formed in alluvium on alluvial fans and flood plains (Apron and Kishona series) and in residuum and colluvium on hills and piedmonts (Chipeta, Greybull, Persayo, Shingle, and Worland series); Torrifluvents (Lostwells and Youngston series) and Natrargids (Uffens series) formed in alluvium on flood plains, alluvial fans, and stream terraces; and Ustorthents (Spearfish series) formed in residuum and colluvium on hills.

Central Rocky Mountains

The dominant soil orders in this area are Inceptisols, Alfisols, and Mollisols. These soils have a frigid or cryic soil temperature regime and an ustic, udic, or xeric soil moisture regime. Soils on mountain side slopes and ridges are formed in colluvium, residuum, and glacial till and have mixed mineralogy. Areas of rock outcrop and rubble land are on ridges and peaks above timberline. Most of the soils are skeletal and are medium textured to coarse textured.

Current Condition

There has been no comprehensive analysis of the current condition of soils and soil health in the Planning Area. There have been qualitative assessments throughout most of the Planning Area using the 17 indicators of rangeland health found in *Technical Reference 1734-6, Interpreting Indicators of Rangeland Health* (BLM 2005c). Of the 17 indicators of rangeland health, ten are used to assess soil and soil site stability. Qualitative assessments using the ten indicators infer improvement of the overall health of the soil resource. The ability of the watersheds to capture and slowly release water without excessive erosion is expected to continue to progress.

Past land uses in the Planning Area have resulted in a network of incised gullies extending into the uplands, often replacing what are thought to have been broad grass-covered swales. This gully network is not restricted to any particular ecological site or plant community and is present throughout the uplands in the 5- to 9-inch precipitation zone and 10- to 14-inch precipitation zone. As a result, peak runoff discharges are of greater intensity and shorter duration, and water is not being retained on the watersheds as it appears to have been in the past. Based on qualitative rangeland health assessments, most gullies are in the process of healing and stabilizing. However, a few gullies still continue to creep farther into the uplands.

Where native plant communities have retained a healthy stand of perennial grasses and shrubs, the ten indicators of soil and site stability reflect that the soils are relatively intact and stable. There is little

evidence (e.g., water flow patterns, pedestals/terracettes, bare ground, and gullies) of past or current erosion, and water is being captured and safely released. The upward trend in overall soil resource health is most pronounced in these plant communities and is expected to continue. Where incised gullies are present, they are expected to continue to heal and stabilize; however, they will continue to channel runoff from the uplands at an accelerated rate.

In areas where the plant communities have shifted to a blue grama sod plant community or a Gardner's saltbush/bare ground plant community, damage to the soil resource is evident. Bare ground is excessive and often interconnected. Loss of the nutrient-rich A horizon is common in bare areas and runoff and erosion exceed the expected rate for the site. However, these plant communities appear to be static, showing neither improvement nor further degradation. The incised gully network in these more degraded sites is expected to slowly improve or remain static.

In areas where the plant communities have shifted to annual grassland dominated by cheatgrass, there is little evidence of damage to the soil resource and runoff and erosion indicators are almost absent. These areas are often characterized by dense stands of cheatgrass, with excessive litter creating an oxidized layer of thatch. Little change to soil and soil site stability is anticipated in these communities. Ongoing research is revealing that cheatgrass-dominated sites undergo biogeochemical changes that alter soil evolution and plant succession.

Wildland fires are occurring more frequently and are becoming larger, and burn with greater intensity over longer periods. When viewed from a soils and watershed perspective, these larger fires lead to increased soil erosion. In many situations, as in the case of cheatgrass monocultures, entire plant communities are shifted as a result of wildland fire.

Despite some evidence that water is not being retained on the landscape as it once was and that soils are being affected in some areas, the soil resource remains capable of producing forage for wildlife and livestock. It is also proving capable of maintaining a balance between infiltration and runoff, thus protecting watershed condition. The soil resource should be capable of sustaining increased demands without long-term impacts. Surface-disturbing activities are likely to be the greatest demand on the soil resource. In the arid climatic conditions common to the Planning Area, long-term soil loss exceeding 2 tons per acre per year could adversely affect the soil resource.

Erosion

Position on the landscape, slope, physical properties, and most notably, surface texture and structure and chemical properties, contribute to susceptibility of soils to wind and water erosion. Slopes greater than 25 percent have a high water erosion potential, whereas slopes from 10 percent to 25 percent are considered to have a moderate water erosion potential (Map 62). Runoff potential is increased if plant communities are disturbed. Many other soils have naturally high runoff potential (Hydrologic Group D) due to high clay content and their tendency to swell when wet.

Susceptibility to water erosion is a function of slope and soil surface texture. As a rule, slopes greater than 25 percent are considered to be highly susceptible to water erosion, particularly after surface disturbance. Management of slopes of 10 percent or greater requires an emphasis on runoff and erosion control. Map 62 shows the percent slope in the Planning Area. Table 3-5 summarizes the number of acres susceptible to water erosion.

Table 3-5. Soils with High Water Erosion Potential in the Planning Area

BLM-Administered Surface		Federal Mineral Estate		All Land Ownership	
Acres	Percent of BLM-Administered Surface	Acres	Percent of Federal Mineral Estate	Acres	Percent of Lands within Planning Area
465,988	14.6	671,002	16.0	824,254	14.6

Source: BLM 2009a

BLM Bureau of Land Management

Using the USFS web-based Water Erosion Prediction Project (WEPP) erosion model, surface-disturbing activities have the potential to increase annual soil loss to levels far greater than 5 tons per acre (WEPP 2008). Site-specific mitigation measures, including timely reclamation, are needed to minimize soil erosion and protect long-term soil productivity. WEPP erosion predictions consistently show that erosion rates following surface-disturbing activities return to background levels within 3 to 5 years following full reclamation.

Wind erosion is not widespread in the Planning Area. Where high winds occur, the soils with sandy surface textures (sand, loamy sand, fine sandy loam, sandy loam) are highly susceptible to wind erosion. Existing soils data is not adequate to make a realistic determination of acres susceptible to wind erosion or to produce a meaningful map of their locations.

Management Challenges

Management challenges for soil resources in the Planning Area stem largely from surface-disturbing activities. Development of mineral resources, including road building, well pad construction, pipeline installation, and vegetation treatments all impact the soil resource. Other actions that affect soils include a variety of surface uses that loosen topsoil and remove vegetation or other ground cover, such as grazing and browsing by animals, off-highway vehicle (OHV) use, development of trails and campgrounds, rights-of-way (ROWs), fire-suppression activities, and prescribed fires. Soil compaction resulting from surface-disturbing activities and associated development can reduce infiltration, increase runoff, and hamper reclamation.

Other challenges include implementing improved reclamation techniques, control of invasive species, and establishment of native plant communities on disturbed sites. In addition, areas where plant communities have shifted to blue grama sod or Gardner's saltbush/bare ground offer a unique management challenge. The BLM applies restrictions and implements mitigation measures and BMPs to protect soil resources (Refer to Appendix H and Appendix L).

3.1.4 Water

This section characterizes surface water and groundwater resources and describes water use and current water management practices in the Planning Area.

The Bighorn Basin is a semi-arid desert that receives little moisture. Lower elevations of the Basin are some of the driest parts of Wyoming. Mean annual precipitation ranges from less than 5 inches to more than 40 inches at higher elevations of mountain ranges. Most precipitation at lower elevations of the basin comes in the form of periodic rainfall from April through June. During these months, most smaller stock reservoirs in the Planning Area depend on these rainfall events to capture and store surface runoff. Snow is very light, with annual averages of 15 to 20 inches at lower elevations and 36 to 48 inches at 5,000 to 6,000 feet amsl. Large snowfall events at lower elevations in the basin are infrequent, with fewer than 3 days annually receiving 5 or more inches.

Surface Water

Surface water resources in the Planning Area fall within U.S. Geological Survey (USGS) Water Resources Region 10 and are all tributaries of the Missouri River. The Bighorn River, Wind River, Clarks Fork of the Yellowstone River, and their associated tributaries, including the Nowood, Greybull and Shoshone river systems, comprise the main source of surface water in the Bighorn Basin. The Bighorn River begins at the Wedding of the Waters and flows through the center of the Bighorn Basin into Bighorn Lake (also known as Yellowtail Reservoir) on the Wyoming-Montana border. The river upstream of Wedding of the Waters is referred to as Wind River. Wind River and its tributaries flow into Boysen Reservoir, which the U.S. Bureau of Reclamation (BOR) manages. The Clarks Fork of the Yellowstone River, flowing out of the Absaroka Mountains, comprises an important source of surface water along the northwest corner of the Planning Area. The North and South Forks of the Shoshone River meet at Buffalo Bill Reservoir (an important water source for the City of Cody and surrounding communities) and then outflow into the Bighorn River, which flows into Bighorn Lake several miles south of the Wyoming-Montana border. Map 3 shows the locations of major surface water features and watersheds at hydrologic unit level 4 in the Planning Area.

Additional watersheds in the Planning Area include Kirby Creek, Nowater River, East Fork of the Nowater River, Fifteenmile Creek, Shell Creek and its tributary (Trapper Creek), Tenmile Creek, Coal Draw Creek, Sand Draw Creek, Elk Creek, Red Canyon Creek, Whistle Creek, Coon Creek, Dry Creek, and Little Dry Creek. Many of the streams in these watersheds, such as those located at lower elevations, are intermittent to ephemeral and flow only in response to snow melt and storm events.

The effective life (and associated costs) of water development projects, such as stock reservoirs and spring developments, depends on watershed conditions. The development and use of resources requiring surface disturbance, resource uses, motorized-vehicle use, and recreation can impact surface water quality, primarily by increasing sediment loads. Stream bank degradation and erosion, and gully erosion (see Section 3.1.3 *Soil*) due to poor vegetative cover and surface disturbances (e.g., roads and construction activities), are the predominant sources of excessive sediment in streams. Proper management of vegetation and surface-disturbing activities such as road construction, forestry, oil and gas discharges, and mining in the Planning Area can mitigate sediment delivery due to these activities.

Public comments during the scoping process indicated that, in particular, the movement of sediment into Bighorn Lake is an issue of concern. Bighorn Lake was formed in 1965 with completion of the Yellowtail Dam (managed by the BOR) across the Bighorn River. The contributing drainage area to this reservoir is 19,650 square miles and consists of the Planning Area and portions of the Bighorn Basin in

Wyoming (USACE and BOR 2009). A 2009 study by the BOR and U.S. Army Corps of Engineers summarized the major causes of sediment production in the drainage basin as the high gradients of the Bighorn Lake tributaries (ranging from about 50 feet per mile in the foothill zone to about 20 feet per mile in the central portion of the Bighorn Basin), low precipitation, the ease with which the underlying rocks in the Planning Area erode, and the lack of vegetative cover to prevent soil erosion (USACE and BOR 2009). The study noted that these factors lead to greater rates of sediment production relative to other nearby drainages, such as the Wind River Basin to the south.

Waters in Wyoming are classified for water quality protection according to existing and designated uses. There are four major classes of surface water in Wyoming with various subcategories within each class (see "Wyoming Water Quality Rules and Regulations, Chapter 1, Surface Water Quality Standards" [Wyoming DEQ 2013d] for descriptions of all subcategories and "Wyoming Surface Water Classification List" [Wyoming DEQ 2013e] for current classifications). The majority of waters in the Planning Area are Class 2 and Class 3. Except for Class 1 waters, each classification is protected for its designated uses plus all uses contained in each lower classification.

Class 1 waters are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. The water quality and physical and biological integrity that existed on the Class 1 water at the time of designation will be maintained and protected. In designating Class 1 waters, the Wyoming Environmental Quality Council considers water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people. The only Class 1 water in the Planning Area is the main stem of the Middle Fork of the Powder River through its entire length above the mouth of Buffalo Creek.

Class 2 waters are waters, other than those designated as Class 1, that are known to support fish and/or drinking water supplies or where those uses are attainable. Uses designated on Class 2 waters include game fisheries, drinking water, nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value. Class 2 waters in the Planning Area include the Clarks Fork of the Yellowstone River and the primary tributaries in the Bighorn River Drainage, including Bighorn River, Shoshone River, Greybull River, Nowood River, Shell Creek, Bear Creek, and Five Springs Creek. The BLM manages some smaller tracts on these waters that provide for habitat and fisheries. Other important Class 2 waters include perennial creeks on the west slope of the Big Horn Mountains and the Absaroka Front, Trapper Creek, Deer Creek, Medicine Lodge Creek, Dry Medicine Lodge Creek, Alkali Creek, Johnny Creek, White Creek, North Beaver Creek, South Beaver Creek, Grass Creek, Cottonwood Creek, Owl Creek, Gooseberry Creek, and others. All provide good-quality water and riparian habitat for wildlife, fisheries, and recreational pursuits.

Class 3 waters are waters, other than those designated as Class 1, that are intermittent, ephemeral, or isolated waters and because of natural habitat conditions, do not support nor have the potential to support fish populations or spawning, or certain perennial waters that lack the natural water quality to support fish (e.g., geothermal areas). Class 3 waters provide support for invertebrates, amphibians, or other flora and fauna that inhabit these waters at some stage of their life cycles. Class 3 waters in the Planning Area include most intermittent and ephemeral tributaries to Class 2 waters such as Sand Creek, Fifteen Mile Creek, and No Water Creek.

Class 4 waters are waters, other than some of those designated as Class 1, where it has been determined that aquatic life uses are not attainable. Uses designated on Class 4 waters include

recreation, wildlife, industry, agriculture, and scenic value. The majority of Class 4 waters in the Planning Area are canals.

The Wyoming DEQ-Water Quality Division (WQD) monitoring program collects scientifically defensible monitoring data using a tiered monitoring approach consisting of core monitoring procedures at all probabilistic and regional reference sites and more intensive, stressor-specific monitoring procedures at a subset of pre-screened sites where designated use support is unknown or at reference sites to meet specific data needs to meet the following objectives: (1) Determine water quality standards attainment, (2) Identify impaired waters, (3) Identify causes and sources of water quality impairments, (4) Assess water quality status and trends at multiple scales, and (5) Respond to complaints and emergencies (Wyoming DEQ 2010).

Wyoming's Integrated Water Quality Assessment Report (305[b] Report) (Wyoming DEQ 2012) summarizes water quality conditions in the state. Streams, rivers, ponds, and lakes that do not support designated uses are considered "impaired." This report includes Wyoming's 2012 303(d) List of Waters Requiring TMDLs (303[d] List), which identifies "impaired" waters that require development of a total maximum daily loads (TMDLs). The state updates this list of streams, rivers, ponds, and lakes every two years and uses the list to develop a TMDL allocation of pollutants. Other "impaired" waters might not require TMDLs, and are identified elsewhere in the 305(b) Report. Table 3-6 lists the streams in the Planning Area that are on the 303(d) List because waters in the stream exceed water quality criteria.

Most streams in the Planning Area are intermittent or ephemeral. When surface water flows occur, these creeks carry large amounts of sediment downstream. The conditions of these watersheds are linked to upland and riparian conditions. Monitoring performed by the BLM, such as proper functioning condition (PFC) assessments (refer to Section 3.4.3 *Vegetation – Riparian/Wetlands Resources*), provide indirect indicators of water quality and watershed health, is commonly tied to specific actions or activities, and is complementary to monitoring and assessments carried out by the Wyoming DEQ-WQD.

The Wyoming DEQ-WQD regulates all surface discharge of water, including water produced from oil and gas development and storm water discharges, through the Wyoming Pollutant Discharge Elimination System (WYPDES) permit process. WYPDES permitted discharges require periodic monitoring, cannot result in a violation of water quality standards in the receiving stream, and must be discharged in a manner that does not cause erosion. Most activities that result in one or more acres of surface disturbance require coverage under a WYPDES storm water permit and require a storm water pollution prevention plan that identifies specific BMPS to prevent or reduce erosion and pollution, prescribes periodic inspection and monitoring, and demonstrates how the proposed plan would prevent a violation of water quality standards in the receiving stream.

All of the waters listed in Table 3-6 have had TMDLs developed for *E. coli,* the current water quality parameter for fecal bacteria, but final approval of the TMDLs has not been granted by the EPA. The *Draft E. coli TMDL for the Bighorn River Watershed* is available online: http://deq.state.wy.us/wqd/watershed/TMDL/Front%20Page%20Misc/Big%20Horn%20TMDL%20Draft%207-5.pdf.

Table 3-6. Wyoming 303(d) Listed Impaired Waters Requiring TMDLs in the Planning Area

Surface Water	Location	Use Support	Cause
Beaver Creek	From Shell Creek upstream an undetermined distance.	Threatened	Fecal Coliform
Big Wash	From Sage Creek upstream to Sidon Canal.	Not Supporting	Fecal Coliform
Bighorn River	Confluence with Nowood River upstream an undetermined distance above the City of Worland.	Not Supporting	*E. coli*
Bighorn River	From Greybull River upstream to Nowood River.	Not Supporting	Fecal Coliform
Bighorn River	From Greybull River downstream an undetermined distance above Bighorn Lake.	Not Supporting	Fecal Coliform
Bitter Creek	From Shoshone River upstream an undetermined distance above Powell.	Not Supporting	Fecal Coliform
Dry Creek	From Bighorn River upstream an undetermined distance.	Threatened	Fecal Coliform
Dry Gulch	From confluence with Shoshone River upstream an undetermined distance.	Not Supporting	*E. coli*
Fifteenmile Creek	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Foster Gulch	From confluence with Shoshone River upstream an undetermined distance.	Threatened	Fecal Coliform
Granite Creek	From confluence with Shell Creek upstream to an undetermined point near Antelope Butte Ski Area.	Not Supporting	Fecal Coliform
Greybull River	From confluence with Bighorn River upstream to the Sheets Flat bridge.	Not Supporting	Fecal Coliform
Kirby Creek	From confluence with Bighorn River upstream an undetermined distance above Lake Creek.	Threatened	Fecal Coliform
Nowater Creek	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Nowood River	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Owl Creek	From confluence with Bighorn River upstream an undetermined distance.	Threatened	Fecal Coliform
Paint Rock Creek	From confluence with Nowood River upstream an undetermined distance.	Threatened	Fecal Coliform
Polecat Creek	From Sage Creek upstream an undetermined distance.	Not Supporting	Fecal Coliform
Sage Creek	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Sage Creek	From Shoshone River upstream an undetermined distance above Big Wash.	Not Supporting	Fecal Coliform
Shell Creek	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Shoshone River	From confluence with Bighorn Lake upstream an undetermined distance.	Not supporting	Fecal Coliform
Slick Creek	From confluence with Bighorn River upstream an undetermined distance.	Not Supporting	Fecal Coliform
Whistle Creek	From confluence with Shoshone River upstream an undetermined distance.	Not Supporting	Fecal Coliform

Source: Wyoming DEQ 2012

TMDL Total Maximum Daily Load

Groundwater

There are 12 major aquifers in the Planning Area – Quaternary, Fort Union/Lance, Willwood, Mesaverde, Frontier, Muddy, Cloverly, Sundance, Phosphoria, Ten Sleep, Madison, and Flathead. The Madison is the primary aquifer that supplies water for several municipalities in the Planning Area (Wyoming Water Development Commission 2003). A general description of physical characteristics, water availability, and water quality for each of the 12 major aquifers in the Planning Area is presented in Table 3-7. Refer to the *Wind/Bighorn River Basin Water Plan* (Wyoming Water Development Commission 2003) and the *Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 (2008-2011)* (Taucher et al. 2012) for additional information on physical and chemical characteristics, water availability, recharge areas, and recharge rates of aquifers underlying the Planning Area.

Table 3-7. Major Aquifers in the Planning Area

Aquifer/Formation	Physical Characteristics	Aquifer Characteristics and Water Quality
Quaternary	Consists primarily of sand and gravel interbedded with finer-grained sediments, such as silt and clay; coarser deposits occur locally. Thickness is dependent on stream or river valley association and ranges between 50 and 200 feet.	Subaquifers in the Quaternary aquifer may have local development potential. Depending on local hydrogeologic conditions, individual wells may yield between 10 gpm to 500 gpm.
Fort Union/Lance	Consists of 4,000 to 6,000 feet of interbedded sandstones, siltstones, and coals.	Reported well yields are typically less than 200 gpm, though yields of more than 1,000 gpm are possible from wells that penetrate more than 1,000 feet of the aquifer. Water quality varies and is typically useful for domestic and livestock use, though sulfate concentrations have exceeded 500 mg/L in some areas.
Willwood	Consists of fine-grained mudstone and shale interbedded with medium grained sandstone and sporadic conglomerates. The Willwood aquifer is nearly indistinguishable from the Fort Union/Lance aquifer in the Bighorn Basin.	Similar to the Fort Union/Lance aquifer.
Mesaverde	Consists of 500 to 2,200 feet of variable sequence of massive lenticular fine- to coarse-grained sandstone, carbonaceous shale, and lesser amounts of coal.	Discharge from the Mesaverde aquifer is both natural and anthropodenic. The primary anthropogenic source of discharge is oil and gas wells. Concentrations of some properties and constituents in the Mesaverde aquifer approached or exceeded applicable EPA or State of Wyoming water-quality standards and could limit suitability for some uses.
Frontier	Consists of 700 to 1,200 feet of alternating sequence of very-fine- to medium-grained sandstone and shale.	Concentrations of some properties and constituents in water from the Frontier aquifer exceeded State of Wyoming standards for agricultural and livestock use.
Muddy	Consists of 20 to 134 feet of sandstone interbedded with mudstone.	The Muddy aquifer is a major oil and gas reservoir. Concentrations of some properties and constituents in the Muddy aquifer approached or exceeded applicable EPA or State of Wyoming water-quality standards and could limit suitability for some uses (i.e., agricultural and livestock use).

Table 3-7. Major Aquifers in the Planning Area (Continued)

Aquifer/Formation	Physical Characteristics	Aquifer Characteristics and Water Quality
Cloverly	Consists of 200 to 300 feet of sandstone interbedded with lenticular cherty pebble conglomerate and thin variegated shale known as the "Dakota Sandstone"; a middle shale unit known as the "Fuson Shale"; and a basal fine- to coarse-grained sandstone known as the "Lakota Sandstone".	Concentrations of some properties and constituents in the Cloverly aquifer approached or exceeded applicable EPA or State of Wyoming water-quality standards and could limit suitability for some uses (i.e., agricultural and livestock use).
Sundance	Consists of 200 to 900 feet of fine- to coarse-grained sandstone with some thin shale and fossiliferous limestone interbeds, and a basal unit that includes siltstone and sandstone grading downward into limestone, dolomite, and cherty pebble conglomerate.	Concentrations of some properties and constituents in the Sundance aquifer exceeded State of Wyoming standards for agricultural and livestock use.
Phosphoria	Consists of 100 to 300 feet of siltstone, mudstone, and silty shale.	Concentrations of some properties and constituents in water from the Phosphoria aquifer and confining unit in the BHB approached or exceeded applicable EPA or State of Wyoming water-quality standards and could limit suitability for some uses (i.e., agricultural and livestock use).
Ten Sleep	Consists of 200 to 600 feet of medium-grained well-sorted sandstone. Present throughout the Planning Area.	Excellent aquifer yielding water under artesian to flowing artesian conditions near range front. Well yield increased quantities where fractured. Water quality decreases away from recharge area (with distance from range front).
Madison	Consists of 300 to 700 feet of massive to thin-bedded limestone, containing some thin beds of chert and shale near the top. Present throughout the area.	Potentially voluminous producer where extensive fracturing and cavities are known to exist. Water quality data are sparse. Completion could be cost prohibitive basin-ward.
Flathead	Cambrian-age Flathead Sandstone consisting of fine- to medium-grained arkosic and quartzitic sandstone.	Might be good source of groundwater where weathered or fractured, yielding high-quality water near outcrops. Depth to completion could be cost prohibitive basin-ward.

Sources: Taucher et al. 2012; Arneson et al. 1998.

EPA Environmental Protection Agency
gpm gallons per minute
mg/L milligrams per liter

Groundwater recharge occurs from direct infiltration of precipitation into the shallower aquifers, from infiltration into the rock outcrop areas of the deeper aquifers, and from leakage between aquifers. Groundwater quality depends primarily on the source geologic formation or aquifer. Groundwater is used to meet the demand of current uses on public land, such as livestock, wildlife, mineral development, and industrial.

Geologic formations aging from Precambrian to the shallow Quaternary deposits produce groundwater throughout the basin. The most reliable and accessible shallow groundwater supplies are from aquifers in unconsolidated deposits along the larger waterbodies such as the Bighorn, Greybull, Nowood, and Shoshone Rivers (Plafcan et al. 1993). The Clarks Fork of the Yellowstone River also provides reliable and accessible supplies of groundwater. Larger producing wells also originate in deep limestone and dolomite aquifers of the Madison Limestone and Bighorn Dolomite formations. These formations crop out along

the flanks of the basin and are found at extensive depths that produce large amounts of water for municipalities and agricultural purposes.

The Madison Aquifer is an important regional water source for the northern plains states (including western South Dakota, Wyoming, and potentially western Montana in the near future) due to increasing populations and development in this area and the limited number of other undeveloped water sources (USGS 2009). Issues related to water levels and the aquifer's recharge rate are some of the primary areas of concern related to this water resource. An important area within the Madison aquifer is the Spanish Point Karst Area of Critical Environmental Concern (ACEC), a specially designated area that protects surface and groundwater recharge areas and sensitive karst watercourses; refer to Section 3.7.1 *Areas of Critical Environmental Concern* for additional information on the Spanish Point Karst ACEC.

Surface Water and Groundwater Quantity and Use

Both surface water and groundwater are sources of water in the Planning Area. Surface water sources typically meet existing uses on public lands, but natural climatic fluctuations, such as drought, can make marginally adequate sources unreliable. Groundwater sources are adequate to meet the demand of all current uses on public land (primarily for agricultural, municipal, industrial, livestock, and wildlife).

Active water wells in the Planning Area are permitted through the Wyoming State Engineer's Office within the four counties of the Planning Area (Wyoming State Engineer's Office 2006). A permittee can apply for water rights on BLM-administered land; if the permittee demonstrates beneficial use, then the Wyoming State Engineer's Office can permit the water right. The issuance of the water right in no way authorizes a permittee to develop water on BLM-administered lands, or any lands that they do not own. This requires independent negotiations between the permittee and the BLM to acquire the appropriate special use permit or ROW. The Wyoming State Engineer's Office does not require that landowner authorization be obtained before it issues the water right. Table 3-8 summarizes water uses in each of the four counties. Approximately 85 percent of the total surface water and groundwater consumptive use in the Planning Area is for agricultural purposes (Table 3-9).

According to the Wyoming Water Development Commission's 2010 Wind/Bighorn River Basin Plan (Wyoming Water Development Commission 2010), there remains approximately 1.8 million acre-feet of unallocated flow for the State of Wyoming to develop. Despite this apparent surplus, many areas in these basins chronically experience water shortages. Groundwater sources are adequate to meet the demand of all current uses on public land (primarily livestock, wildlife, and recreation); however, there has been substantial local water development in recent years, which may result in excessive depletion that could affect current or future demand.

There is an anticipated increase in future demand for surface water for irrigation and other consumptive uses in the Planning Area. The *Wind/Bighorn River Basin Plan Update* (Wyoming Water Development Commission 2010) projected future demand for water in the Bighorn Basin based on three planning scenarios for 2020, 2040, and 2060:

- Low scenario: This scenario represents the minimal likely development, or possible contraction, in the Basin. Although this scenario will not result in any new water demand pressures in the Basin due to socioeconomic activity, it provides a supportable lower limit for water planning purposes.
- Medium scenario: This scenario represents the most likely set of factors that will occur in each of the Basins over the planning horizon. This scenario represents the most probable future conditions in the Basin in the opinion of the study team.

- High scenario: This scenario represents the highest growth that could potentially occur in the Basin over the planning horizon. These conditions will provide an upper boundary for water planning in the Basin.

Table 3-10 lists the total new water requirements in the Bighorn Basin for each scenario discussed above. Due to unappropriated surface water, future reservoirs in the area are possible.

Oil and gas development can result in large volumes of produced water that can have beneficial and adverse effects on surface water and can reduce groundwater availability; however, water users in the Planning Area overwhelmingly view produced water as beneficial. The release of produced water can increase or extend the period of flow in drainages; such releases can provide valuable sources of water and are highly coveted by users in the Planning Area. However, discharges of produced water also can increase the total dissolved solids concentration of surface waters, result in increased survival and spread of invasive species adapted to the conditions created, and substantially increase erosion in ephemeral drainages (BLM, State of Montana DEQ, and MBOGC 2003; BLM 2009g).

Table 3-8. Uses of Active Well Permits by County

County	Use	Number of Active Permits
Big Horn County	Domestic	2
	Industrial, Miscellaneous	2
	Miscellaneous	10
	Miscellaneous, Irrigation	1
	Miscellaneous, Municipal	1
	Stock	106
	Stock, Irrigation	1
	Stock, Municipal	6
	Total	**129**
Hot Springs County	Domestic, Stock	3
	Industrial	2
	Industrial, Miscellaneous	5
	Miscellaneous	12
	Monitoring	5
	Stock	277
	Test Well	3
	Wildlife	1
	Wildlife, Stock	3
	Total	**311**

Table 3-8. Uses of Active Well Permits by County (Continued)

County	Use	Number of Active Permits
Park County	Domestic	2
	Domestic, Stock	7
	Industrial	9
	Industrial, Miscellaneous	1
	Irrigation	2
	Miscellaneous	5
	Stock	82
	Total	**108**
Washakie County	Domestic	1
	Domestic, Stock	2
	Industrial	2
	Irrigation	1
	Miscellaneous	5
	Stock	115
	Total	**126**

Source: Wyoming State Engineer's Office 2006

Table 3-9. Water Use Summary in the Wind/Bighorn River Basin, 2010

Type of Water Usage	Diversion (acre-feet)[1]	Consumptive Use (acre-feet)
Municipal and Domestic	21,324	8,743
Industrial/Mining	91,906	19,163
Agricultural (Irrigation)	3,136,728	1,079,971
Stock Water[2]	6,370	6,370
Reservoir Evaporation	156,157	156,157
Recreation	Non-consumptive	
Environmental	Non-consumptive	
Total	**3,412,485**	**1,270,404**

Source: Wyoming Water Development Commission 2010

[1]Includes both surface water and groundwater use.
[2]Consumptive use not calculated for stock water use.

Table 3-10. Projected New Demand for Water Usage from the Wind/Bighorn River Basin

Year	Water Usage	Projected Growth Scenario (acre-feet)		
		Low	Moderate	High
2020	Municipal and Domestic	-300	500	1,600
	Industrial	22,800	35,300	40,800
	Agricultural	-75,000	100	55,000
	Wind River Indian Reservation	0	0	0
	2020 Total	**-51,900**	**35,900**	**97,400**
2040	Municipal and Domestic	1,000	2,000	4,800
	Industrial	74,200	126,600	152,700
	Agricultural	-200,000	200	153,000
	Wind River Indian Reservation	0	19,000	75,000
	2040 Total	**-124,800**	**147,800**	**385,500**
2060	Municipal and Domestic	1,700	3,500	8,600
	Industrial	148,800	283,600	359,200
	Agricultural	-320,000	500	254,000
	Wind River Indian Reservation	0	19,000	209,000
	2060 Total	**-169,500**	**306,600**	**830,800**

Source: Wyoming Water Development Commission 2010

Management Challenges

There are a number of management challenges for water resources in the Planning Area. Surface water quality must be maintained or improved in compliance with federal standards, while development and other resource use can impact surface water quality by increasing sediment load. Sediment loading into Bighorn Lake is an issue of public concern. Currently, groundwater sources are adequate to meet the demand of all current uses on public land, yet the anticipated increase in future demand for irrigation and other consumptive uses could affect the level and recharge rate of important aquifers. Produced water is also a management challenge. Many residents indicate produced water is beneficial to the users, yet these discharges can also adversely affect surface water quality and increase invasive species prevalence and erosion.

3.1.5 Cave and Karst Resources

A cave is any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the Earth, or within a cliff or ledge large enough to permit an individual to enter, whether or not the entrance was naturally formed or man-made (The Federal Cave Resources Protection Act [FCRPA], Sec. 3[1]). Cave and karst resources are abundant in the Bighorn Basin. Karst topography consists of landforms produced by the dissolution of rock creating a variety of landscape features, including caves, which are common in the Planning Area. Cave and karst resources are fragile because of their association with other resources such as groundwater systems and biological communities. They also might be considered nonrenewable resources because of paleontological and archeological deposits, and speleothems (mineral formations inside caves) they contain.

In the Planning Area, the cave and karst system along the west slope of the Big Horn Mountains in the Medicine Lodge area is important due to mineral features such as speleothems, potential for diverse karst aquatic organisms, cultural and paleontological resources, and recreation opportunities. This area is hydrologically important because of the presence of disappearing surface water streams and its link to regional groundwater aquifers. This system includes rock outcrops of the Madison Limestone, Bighorn Dolomite, and Ten Sleep Sandstone, all of which are primary recharge areas for regional aquifers in the Bighorn Basin. A portion of this area is designated as an ACEC for the protection of cave and karst resources (refer to Section 3.7.1 *Areas of Critical Environmental Concern* for more information).

The FCRPA of 1988 was the first federal legislation to recognize caves and their contents as whole, integrated ecosystems. FCRPA declares significant caves on federal lands as an invaluable and irreplaceable part of the Nation's heritage. U.S. Department of the Interior (DOI) implementation regulations for FCRPA require that federal lands be managed in a manner that, to the extent practical, protects and maintains significant caves and cave resources (43 Code of Federal Regulations [CFR] Part 37.2). BLM policy and guidance for managing cave resources is to protect sensitive, fragile, biological, ecological, hydrological, geological, scientific, recreational, cultural, and other cave values from damage and to ensure they are maintained for public use, both now and in the future (BLM 2008b).

Under FCRPA, a cave is considered significant if it meets one or more of the following six criteria:

Biota – The cave serves as seasonal or yearlong habitat for organisms or animals, or contains species or subspecies of flora or fauna native to caves, or is sensitive to disruption, or contains species found on state or federal sensitive, threatened, or endangered species lists.

Cultural – The cave contains historic or archeological resources included on or eligible for inclusion on the National Register of Historic Places (NRHP) because of its research importance for history or prehistory, its historical association, or other historical or traditional significance.

Geological/Mineralogical/Paleontological – The cave has fragile geologic or mineralogic features, features that exhibit interesting formations, or paleontological resources.

Hydrologic – The cave is part of a hydrologic system or contains water important to humans, biota, or development of cave resources.

Recreational – The cave provides or could provide recreational opportunities or scenic values.

Educational or Scientific – The resource offers opportunities for educational or scientific use or is in a virtually pristine state, lacking evidence of contemporary human disturbance or impact, or the length, height, volume, total depth, or similar measurements are notable (43 CFR Part 37).

There are 32 known caves in the Planning Area, of which 19 are considered significant according to FCRPA criteria (BLM 2009a). Eight caves are gated and locked and three caves are open through the issuance of a key and permit. Recreational use of these caves is minimal, except by local cave enthusiasts. Horsethief, Spirit Mountain, and Great Expectations caves typically experience the highest level of recreational use. The BLM manages all caves in the Planning Area in a wild state; there are no developed caves on public lands in the Planning Area. Bats use several caves in the Planning Area and the BLM lists three of those bat species (Townsend's big-eared bat, spotted bat, and long-eared myotis) as sensitive.

Management Challenges

Management challenges for cave resources include preventing degradation of the resources while allowing for recreational use and scientific research.

3.2 Mineral Resources

Mineral resources in the Planning Area include locatable (bentonite, gypsum), leasable (coal, oil shale, geothermal, oil and gas, other solid leasable minerals), and salable (sand, gravel) minerals. Each section below defines and describes the resource, its current condition, and management challenges. Split-estate lands are where the United States owns the minerals under privately owned surface. Most of the split-estates resulted from patents for the surface issued under homestead laws such as the Stock Raising Homestead Act of 1916. Federal mineral lease holders or persons locating a mining claim may enter onto a privately owned surface to the extent necessary to explore and produce the federal minerals in compliance with relevant statutes and BLM regulations and land use designations. See 43 U.S.C. 299; 43 C.F.R. subpart 3814, and Onshore Oil and Gas Order No. 1, sec. VI (72 Fed. Reg. 10308, 10336). The BLM does not have the authority to regulate a surface owner's use of the surface estate, but does have the authority to regulate various activities of federal mineral lessees and mining claimants. See Appendix Z for additional details regarding split-estate lands and BLM administrative responsibilities for managing the federal minerals.

3.2.1 Locatable Minerals

Locatable minerals (metallic and nonmetallic) are those open to mining claim location under the General Mining Law of 1872, as amended (30 U.S. Code [U.S.C.] 22-54 and 611-615). The primary locatable minerals mined commercially in the Planning Area are bentonite (Map 4) and gypsum (Map 5). Other locatable minerals known to occur in the Planning Area include titaniferous sandstone, placer gold, uranium, and sulfur; however, these minerals are not known to occur in commercially viable quantities in the Planning Area. Silica sand is present in the Bighorn Basin in the John Blue Canyon deposit, and is of sufficient quality for glass, fused silica, metallurgical flux, abrasives, fillers in ceramics, and as an ore for making silicon metal (BLM 2009d). However, the prohibitive quantity of overburden overlying known silica sand resources would make any attempt at commercial production very difficult. Base and precious lode metals such as gold, silver, platinum, and copper are not known to occur in commercial quantities in the Bighorn Basin. Precious and semiprecious stones are not known to occur in the Planning Area. For more information on locatable minerals in the Planning Area, refer to the *Solid Mineral Occurrence and Development Potential Report* (BLM 2009d).

A mining claim is an ownership interest in a particular parcel of federal land that is valued for a specific mineral deposit. Mineral prospecting and claim location can take place only on lands open to mineral entry. Claims may not be staked in areas withdrawn from mineral entry by a special Act of Congress, regulation, or public land order. These areas are withdrawn from the operation of the mining laws.

The right of possession provided by a mining claim is restricted to the extraction and development of a mineral deposit as regulated by the BLM or the USFS. The rights granted by a mining claim are valid against a challenge by the United States and other claimants only after the discovery of a valuable mineral deposit. A mining claim is generally referred to as a "lode claim" if mineralization occurs as a vein of ore in place, or as a "placer claim" if minerals are dispersed among particles of sand or gravel. A millsite claim is one used to process locatable minerals.

The BLM locatable mineral program addresses authorization and permitting of locatable mineral exploration, mining, and reclamation activities on BLM-administered land, and is mandated by section 302(b) of the Federal Land Policy and Management Act of 1976 (FLPMA) (43 U.S.C. 1732[b] and 603[c]; 43 CFR 3802 and 43 CFR 3809). All locatable mineral exploration and development activities that disturb the surface of the mining claim (site) require prior BLM acceptance (for a notice) or authorization (for a

plan of operations). Operations obtain necessary authorizations and permits through the BLM field office responsible for administering the land in which the minerals are located.

Operators must obtain all necessary permits before they begin mining, even if they already filed a mining claim. Surface management regulations apply to activities on unpatented mining claims. These regulations are designed to prevent unnecessary or undue degradation of public lands from operations authorized by the mining laws. They require the filing of a notice or a plan of operations for all activity exceeding casual use. Regulations that went into effect on January 20, 2001 (revised 3809 regulations), require that notices include a bond, and will only apply to exploration activities, not to any production operations. Disturbed areas must be reclaimed after exploration and mining activities are completed. All reclaimed areas and reclamation plans will fulfill federal, state, county, and other local agencies requirements in compliance with the BLM Solid Minerals Reclamation Handbook, H-3042-1. The state of Wyoming also has statutes and rules regarding mining and reclamation requirements. To avoid duplication, the BLM and the Wyoming DEQ have entered into a cooperative agreement via a Memorandum of Understanding (MOU). Operators are advised to check with the BLM and the Wyoming DEQ to determine the proper lead agency before submitting a notice or plan of operations.

Bentonite and gypsum are the only locatable minerals currently extracted in commercial quantities in the Planning Area. Bentonite consists of hydrous silicate of alumina, more commonly known as montmorillinite or beidelite. It can swell up to 16 times its original size, and absorb up to 10 times its own weight in water. It is used for absorbents, animal feed, drilling fluids, foundry, iron-ore pelletizing, and sealants. It is increasingly being used for cat litter, and this could become the largest single market for Wyoming bentonite early in the 21st Century. It is used in drilling mud to lubricate oilfield drilling equipment, hold back formation pressure, and to help prevent caving of the drill hole. Used in the foundry industry, it acts as a molding sand binder when added to taconite and for binding iron pellets, which are later fed into a blast furnace for processing. Bentonite is also used to seal reservoirs and landfills. Other uses include crayons, medicines, food thickeners, and cosmetics.

Bentonite deposits in Wyoming make up approximately 70 percent of the world's known supply. In 2010, Wyoming's bentonite industry mined approximately 4.5 million tons of bentonite, of which approximately 2.8 million tons were mined at six operations in the Bighorn Basin. The six mines in the Bighorn Basin employ 108 persons, and another 190 persons are employed at the milling-processing facilities at six different mills (one in the Worland area, two near Greybull, and three near Lovell, Wyoming (Wyoming Water Development Commission 2010). This is a reduction from 116 mine workers and 340 mill workers working in the basin in 2006 (Wyoming Water Development Commission 2010). The number of additional contracted employees performing jobs that service the bentonite industry in the Bighorn Basin, such as equipment operators and truck drivers, is subject to change based on market conditions. The Wyoming DEQ Land Quality Division permits these broad mining areas; the BLM has surface management plan of operation files covering portions of bentonite mine operations on public lands.

Wyoming bentonite production has increased from 1,141 tons in 1927, to more than 500,000 tons in 1950, more than 2 million tons in 1970, almost 3 million tons in 1990, and more than 4.5 million tons in 2005. Production of Wyoming and Bighorn Basin bentonite has been relatively steady since 2005.

Gypsum (hydrated calcium sulfate) is used primarily in the manufacture of plaster. The development of prefabricated wallboard revolutionized the industry again in the 1960s. Approximately two-thirds of the gypsum currently marketed is in the form of prefabricated products. Gypsum is precipitated primarily from seawater, but can be deposited in saline lakes or hot springs. It often occurs as a product of volcanic activity and can occur in metallic mineral veins.

Commercially important gypsum deposits in the Bighorn Basin are found only in the Jurassic Gypsum Spring Formation. Two mines actively mine gypsum in the Planning Area and employ up to 200 persons in their mines and mills. The CertainTeed gypsum mine is south of Cody, Wyoming, and produces from three thick gypsum beds totaling approximately 35 feet. The Georgia Pacific Gypsum, LLC, mine southeast of Lovell, Wyoming, mines nine seams of gypsum, each separated by thin red shale, for a total of approximately 30 to 40 feet of gypsum.

Most of the gypsum from the Bighorn Basin is used to make wallboard, although other related products are also being made. A total of about 1.5 million tons of gypsum have been mined in the Planning Area since commercial mining began.

Table 3-11 lists active mining notices, the number of plans of operation, and production quantities for bentonite and gypsum in the Planning Area. Other locatable mineral commodities such as sulfur, uranium, titaniferous, or silica sand are not expected to be developed in the Planning Area, subject to market conditions that are not easily forecast. For more information on other locatable minerals that are present in the Planning Area, refer to the *Solid Mineral Occurrence and Development Potential Report* (BLM 2009d).

Table 3-11. Mining Notices and Plans of Operations in the Planning Area, as of 2008

Commodity	Number of Notices	Number of Plans of Operation	Produced Amount (tons)
Bentonite	30	21	2,996,858
Gypsum	1	2	296,862

Sources: CertainTeed Gypsum 2008; Georgia Pacific Gypsum, LLC 2008; BLM 2009d; Wyoming Department of Employment, Office Of Mine Inspector 2008.

Management Challenges

Management challenges for locatable minerals in the Planning Area include surface disturbance and impacts to other resources due to mining activities. Approximately 30,000 acres of land has been or is proposed to be disturbed in the Bighorn Basin due to bentonite mining, which includes approximately 4,000 acres of road and haul-road disturbance (BLM 2008a). Between the CYFO and the WFO, another 20,000 acres of additional bentonite mining is a RFD scenario over the next 20 to 30 years (BLM 2008c).

As surface disturbance due to increased amounts of locatable mineral mining continues to grow in the Planning Area, loss of native habitats and resources increases. Sagebrush is very difficult to reestablish once removed, and can take 30 to 50 years to become reestablished in a mined area. Critical thresholds relevant to continued development of locatable minerals in the Planning Area have not been specifically determined under the existing management scenario. However, using the Geographic Information System (GIS), the BLM might be better able to determine threshold levels of disturbance in relation to locatable mineral (primarily bentonite) mining, and be better able to make future decisions because of these capabilities. A major challenge the BLM faces relates to improvement of sagebrush reclamation in mine areas and determination of direct and cumulative effects of locatable minerals mining on sage-grouse and their habitat, and how to mitigate these effects. In particular, the cumulative, ongoing effect of bentonite mining related to loss of sagebrush habitat and reclamation issues, coupled with the increase in focus on protection of the greater sage-grouse, will become a much more important issue for the BLM.

3.2.2 Leasable Minerals – Coal

Coal is a combustible stratified organic sedimentary rock composed of altered or decomposed and reconstituted plant remains of non-marine origin, combined with varying minor amounts of inorganic material. Different types of coals are classified by their degree of metamorphism in accordance with standard specifications of the American Society for Testing Materials. Most Wyoming coals are classified as bituminous or sub-bituminous.

Coal is classified as a leasable solid mineral under the Mineral Leasing Act of 1920. The BLM manages coal leasing and other administrative duties related to coal production from federal coal lands throughout the United States pursuant to the 43 CFR Part 3400, Coal Management.

Wyoming has the largest federal coal program in the BLM. Most Wyoming coal is used for steam generation in the electrical utility industry. Coal production in Wyoming comes from four primary areas – (1) the Powder River Basin in northeastern Wyoming, (2) the Hanna Basin in south central Wyoming, (3) the Rock Springs area, and (4) the Kemmerer area in southwestern Wyoming.

Coal mining in the Bighorn Basin dates back to the 1890s (Glass et al. 1975), when it was primarily mined for use as a domestic fuel and fuel for the railroad industry. Between 1910 and 1929, approximately 500,000 tons per year were mined; between 1920 and 1956 approximately 90,000 to 200,000 tons per year were mined; however, by the mid-1950s, after railroads converted to diesel engines, annual tonnage dropped to less than 10,000 (Glass et al. 1975; BLM 1993). Historically, most coal mined in the Bighorn Basin was extracted from coalbeds within the Mesaverde Formation, which is, therefore, the most important coal-producing formation in the Bighorn Basin (Glass 1981). Most coal produced from the Bighorn Basin has been mined from the Gebo and Grass Creek Coal Fields.

Coal is the only solid leasable mineral currently mined in the Planning Area. There is only one active coal mine in the Planning Area, and it produces about 70,000 to 100,000 tons per year from the Grass Creek Coal Field. This coal mine is on private land, not BLM-administered land (BLM 2008c).

Currently, there are no exploration licenses or leases issued for federally administered coal in the Planning Area (BLM 2008c). However, there are federal coal resources in the Planning Area, primarily in the Cretaceous Mesa Verde, Meeteetse, and Paleocene Fort Union Formations. Several scattered parcels of land have mineral reservations specifically for coal or designated coal classifications. Although there is record of historic mining in the area and the USGS has identified eight important coal fields (DOI 2009), coal production in the Planning Area is generally not considered economically feasible due to the relative thinness of the coalbeds, thickness of the overburden, and low quality of the coal. Map 6 shows known and potential coal-bearing strata in the Planning Area.

Management Challenges

At present, there is no coal leasing or production on BLM-administered land in the Planning Area. Therefore, the BLM has not identified management challenges for this resource. However, if coal leasing and development were to occur in the Planning Area, management challenges could result due to conflicts with other program areas, such as oil and gas activities.

3.2.3 Leasable Minerals – Oil Shale

Oil shale is considered a leasable solid mineral under the Mineral Leasing Act of 1920. The BLM manages oil shale leasing, research and development leasing, and production, and performs other administrative duties related to oil shale production from federal lands in the western United States.

In August 2005, the U.S. Congress enacted the Energy Policy Act of 2005 (Public Law 109-58). In Section 369 of this Act, also known as the "Oil Shale, Tar Sands, and Other Strategic Unconventional Fuels Act of 2005," Congress declared that oil shale and tar sands (and other unconventional fuels) are strategically important domestic energy resources that should be developed to reduce the Nation's growing dependence on oil from politically and economically unstable foreign sources. In 2008, the BLM released a Programmatic EIS for oil shale and tar sands that amended existing RMPs in Wyoming and other states. The only areas of Wyoming addressed in that Programmatic EIS were the Washakie and Green River Basins in the southwestern part of the state. In 2011, the BLM re-reviewed the land allocations analyzed in the 2008 PEIS and subsequently, via a 2013 ROD, closed certain areas in Wyoming that were open for application for future leasing and development of oil shale and tar sands resources under the 2008 Programmatic EIS.

Oil shale has been described as occurring in thin, low-quality beds in the Eocene Tatman Formation in the central Bighorn Basin. Oil shale resources in the Bighorn Basin are not considered economically feasible to produce using mining or in-place production of kerogen, due to the relative thinness of the oil shale beds, thickness of the overburden, and extremely poor quality of any oil shale. There are an estimated 27 million barrels of undiscovered oil in the Bighorn Basin. At present, due to a lack of commercially valuable resources, no oil shale is leased on BLM-administered land in the Planning Area. Based on these resource values, the BLM did not amend existing plans for the Planning Area for oil shale leasing under the Programmatic EIS for Oil Shale and Tar Sands Resources (BLM 2009c), nor did the BLM make lands in the Planning Area available for applications for oil shale leasing.

Management Challenges

Because there is no oil shale leasing in the Planning Area, the BLM has not identified management challenges.

3.2.4 Leasable Minerals – Geothermal

Geothermal resources are underground reservoirs of hot water or steam created by heat from Earth's interior. Geothermal steam and associated geothermal resources include (1) all products of geothermal processes, including indigenous steam, hot water, and hot brines, (2) steam and other gases, hot water, and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations, (3) heat or other associated energy found in geothermal formations, and (4) any byproducts (see 43 CFR 3200.1) of the above resources. Geothermal steam and hot water are naturally discharged at Earth's surface in the form of hot springs, geysers, mud pots, and steam vents. As an energy source, geothermal resources of hot water or steam are extracted and supplied to steam turbines that generate electrical energy. Geothermal resources also include subsurface areas of hot, dry rock (BLM and USFS 2008a). The BLM field offices in the Bighorn Basin are responsible for supervising and managing all exploration, development, and production operations on any federal geothermal leases in the Planning Area.

Energy derived from geothermal sources is considered a renewable energy resource. Geothermal energy is classified as a renewable energy source because the water used for geothermal energy is replenished by rainfall and the heat and steam harvested for geothermal energy is continuously produced inside Earth.

There are three geothermal areas in the Planning Area, although none is considered viable for use to generate electricity (with current technology and market conditions), and the BLM has not issued

federal geothermal leases (BLM 2008c). The Cody Hydrothermal System extends from the DeMaris Hot Springs 1 mile west of Cody to the Horse Center anticline 7 miles south of Cody. The Cody Hydrothermal system reaches maximum temperatures of 113°F to 131°F at depths of 853 to 1,640 feet. The Thermopolis Hydrothermal System extends east from the Hamilton Dome oil field area about 15 miles to the Warm Springs oil field area. This area reaches temperatures between 115°F and 176°F and is used by several private residences and commercial entities. Water from this system surfaces naturally at Hot Springs State Park, but is not used for municipal heating purposes in the nearby town of Thermopolis. The Bighorn Basin area produces high-temperature water in some of its aquifers because of the thickness of the overlaying sedimentary rock layer; the highest temperature measured in the basin was 306°F at a recorded depth of 23,081 feet (BLM 2009a).

The USGS has not identified any conventional (hydrothermal) geothermal resources in the Planning Area capable of generating electricity (USGS 2008a). In addition, the USGS reports geothermal resource occurrence as low for the entire Planning Area, with the exception of the thermal springs near Thermopolis, which the USGS ranks as moderately low. It should be noted, however, that at an average depth of 6.5 kilometers (approximately 21,000 feet), all of the lands in the Planning Area have temperatures in excess of 150 degrees Celsius (°C) (approximately 300°F), sufficiently hot for hot- and moderate-temperature hydrothermal systems, but at depths currently uneconomical for development (BLM 2008a). Known geothermal resources being exploited by the public or by individuals are primarily on private or state-owned lands in the Planning Area.

The Final Programmatic EIS for Geothermal Resources in the Western United States (BLM and USFS 2008a) describes the Bighorn Basin as having "potential" for geothermal resource development. The BLM is aware of a low to moderate potential for some level of interest in Bighorn Basin geothermal resources over the next 10 to 20 years.

Due to current policy direction guiding the development of renewable energy resources on public lands, there could be increased interest in geothermal development in the Planning Area. The American Reinvestment and Recovery Act of 2009 provides for $350 million in new investment in geothermal energy for research on technology, exploration, development techniques, and geothermal resource assessments (DOE 2009). Should geothermal leasing begin in the Bighorn Basin at some level, the CYFO and WFO would likely be able to accommodate some geothermal resource development over the next planning cycle (BLM 2009a). The BLM would work carefully to ensure that interests in geothermal development in the Bighorn Basin would not adversely affect the geothermal resource at Thermopolis, which the community holds in high regard.

Readers can find additional information and related studies on geothermal resources and development potential in the *Reasonable Foreseeable Development Scenario for Geothermal, Bighorn Basin Planning Area* (BLM 2009h).

Management Challenges

Management challenges are most apparent near the natural hot springs at Thermopolis. The management challenge would be to ensure that any potential geothermal development did not deplete water or heat from the system and therefore adversely affect the Thermopolis hot springs, the local tourism based economy, or the quality of life of local residents. The BLM would take care to consider the views of local, state, and national communities, and use the best available scientific information, before considering geothermal leasing in this area.

3.2.5 Leasable Minerals – Oil and Gas

Oil and gas resources are often found in the pore spaces of sedimentary reservoir rocks, such as sandstone and limestone. These resources migrated from source rocks rich in organic material, such as marine shales. When rocks containing this organic material are subjected to heat and pressure, the organic compounds break down over time, resulting in the formation of oil and natural gas. Once formed, oil and gas can migrate through pores spaces in the host rock or along fractures until it encounters structural, stratigraphic, or combination traps. Coalbed natural gas (CBNG) is present in areas where gas is trapped in the coalbed where it was generated.

The Planning Area has 4,138,024 acres of BLM-administered oil and gas mineral estate out of 5,644,868 acres in the Planning Area, or about 73 percent of the total Planning Area. State, private, and other entities manage the remaining 1,506,844 Planning Area acres (27 percent). Approximately 879,994 acres of state and private surface lands in the Planning Area are split-estate lands that overlie BLM-administered oil and gas mineral estate (subsurface) (BLM 2014a).

Exploration

The BLM is responsible for authorizing and administering geophysical exploration operations on all public surface lands, and under the rights granted under all federal oil and gas leases unless the USFS administers the surface (whether or not such leases are under non-federal land) in the Planning Area. The Wyoming Oil and Gas Conservation Commission (WOGCC) is responsible for authorizing all operations on state and private surface land in instances where such operations are not covered by rights granted under federal oil and gas leases. The BLM authorizes geophysical exploration under a federal oil and gas lease via Sundry Notice approval if the applicant of the geophysical Notice of Intent (NOI) is the federal oil and gas lessee/operator (43 CFR 3150). At the leasing stage, the BLM applies appropriate stipulations on federal oil and gas leases, including standard oil and gas stipulations (Appendix I), and special stipulations identified in the RMP.

Oil and gas reservoirs can be discovered by direct or indirect exploration methods. Direct methods include mapping of surface geology, observing seeps, and gathering information on hydrocarbon observed in drilling wells. Indirect methods often use geophysical methods such as gravity and magnetic and seismic surveys to delineate subsurface features that might contain oil and gas resources not directly observable. The petroleum industry utilizes 2D and 3D seismic technology to obtain subsurface stratigraphic and structural information useful for exploration of oil and gas reserves. 2D seismic technology uses explosives in drilled shot holes for source points along linear survey lines. 3D seismic techniques generally use source points such as vibroseis or shaker trucks in a grid pattern over a large area that can cover hundreds of square miles.

Several companies have leased BLM-administered lands in the Planning Area, and limited exploratory drilling for natural gas has commenced. Two specific areas include:

Southeastern Beartooth Front – There has been seismic exploration along the eastern Beartooth Front northwest of Clark, Wyoming, and exploratory drilling is anticipated. Initially, this activity was situated on private and state land and mineral estates, but is now expanding onto federal (USFS and BLM) lands.

Deep Basin-Centered Gas – Another area receiving new interest is a northwest-trending structural trend related to the deep Bighorn Basin-center gas play, although there is disagreement to the amount of natural gas in these reserves. The USGS estimates that there are more than 989 billion cubic feet (Bcf) of natural gas in low permeability basin-centered gas accumulations in the Bighorn Basin (USGS 2008b). In addition, an estimated 13 million barrels of undiscovered natural gas liquids are projected to exist in

the Bighorn Basin. The Wyoming State Geological Survey is investigating three major types of natural gas resources in Wyoming – tight-sand gas (basin-center gas or deep basin gas), shale gas, and under-pressured gas (Wyoming State Geological Survey 2008). There could be large amounts of all three types of natural gas in the Bighorn Basin.

The approved number of NOI to conduct geophysical exploration operations has been approximately one or two per year since 1999 (BLM 2009a). There has been an increase in the number of seismic ventures in the state, and this trend is expected to continue based on data from the WOGCC (BLM 2009a).

Oil and Gas Leasing Procedures

Leasing procedures for oil and gas, including CBNG, are the same. Based on the federal Onshore Oil and Gas Leasing Reform Act of 1987, all parcels must first be offered competitively. Lands that do not receive competitive interest are available for noncompetitive leasing for a period not to exceed 2 years. Before making a decision whether to offer lands for leasing, BLM conducts an environmental review and determines what resource conflicts exist on the parcels under consideration. Leases for offered parcels may include stipulations to protect other resource values, including:

- Phased leasing;
- Lease stipulations, including No Surface Occupancy, Timing Limitation, and Controlled Surface Use;
- Planned or required unitization of federal lands;
- Phased development; and
- Caps on new surface disturbance, pending acceptable interim or final reclamation;
- Best management practices, such as:
- Use of existing infrastructure;
- Multiple wells on a single pad;
- Requirements to reduce or capture emissions;
- Liquids gathering systems to centralized offsite production facilities;
- Placement of all linear disturbances in corridors;
- Extensive interim reclamation of roadway disturbance to the road surface and of pads to the wellhead; and
- Final reclamation to restore the landform and native plant community.

The BLM Wyoming State Office holds competitive sales four times a year by oral auction and issues competitive and noncompetitive leases for a term of 10 years. If the lessee establishes hydrocarbon production, the competitive and noncompetitive leases can be held for as long as oil or gas is produced. The federal government receives yearly rental fees on nonproducing leases. The state of Wyoming receives approximately half of all money generated from oil and gas leases. Royalty on production is received on producing leases, approximately one-half of which is allocated to the state of Wyoming. After acquiring an oil and gas lease, and prior to development, an application for permit to drill (APD) must be filed with the WOGCC and the appropriate BLM field office if the well proposes to explore or develop a federal oil and gas lease in the Planning Area. After the BLM approves the permit, the company may proceed with drilling according to the conditions of the permit's approval.

Numerous oil and gas operators depend on the ability to lease federal minerals under the BLM leasing program. Public land/leasable fluid minerals are leased to oil and gas operators through an established process for opening public land and areas nominated and approved for leasing. The BLM field offices are responsible for supervising and managing all exploration, development, and production operations on federal oil and gas leases in the Planning Area.

The general policy and main objectives of the BLM oil and gas program are to foster a fair return to the public for its resources, to ensure activities are environmentally acceptable, and to provide for conservation of the fluid mineral resources without compromising the long-term health and diversity of the land.

Oil and Gas Activity in the Planning Area

Under the existing plans, except for Wilderness Study Areas (WSA), some wild and scenic river (WSR) eligible waterways, and the Spanish Point Karst ACEC, BLM-administered lands in the Planning Area are open to oil and gas leasing and exploration. These specially designated areas represent a total of approximately 154,861 acres that are closed to leasing in the Planning Area. This is almost 5 percent of the BLM-administered surface acres in the Planning Area and 3.7 percent of the total 4,203,213 acres of federal mineral estate in the Planning Area (including split-estate lands).

There are 82 operators actively exploring for or producing oil and gas resources in the Planning Area. As of June 2008, federal oil and gas leases covered approximately 960,000 acres in the Planning Area (BLM 2008a) (Map 7). Table 3-12 lists the number of leases and total number of acres under lease in each county.

Table 3-12. Number of Oil and Gas Leases by County, as of June 2008

County	Number of Leases	Area under Lease (acres)
Big Horn	180	158,565
Hot Springs	304	230,473
Park	156	106,944
Washakie	477	465,281

Source: BLM 2008a

Approximately 547 oil and gas wells were spudded (started) in the Planning Area from January 1, 1999, to December 31, 2008 (BLM 2014a). Each well, including roads, pipelines, and similar infrastructure, is assumed to disturb approximately 2.5 acres for initial drilling operations (accounting for approximately 1,368 acres of new disturbance in the Planning Area). Upon completion of operations, interim reclamation measures are implemented, reducing the disturbance by up to 50 percent, or 684 acres (BLM 2009a). Table 3-13 lists oil and gas well statistics for the Planning Area.

There have been 9,928 surface well locations spudded in the Planning Area through March 3, 2009 (WOGCC 2009). Of the 9,928 wells spudded or drilled in the Planning Area, 6,133 wells, or 61.8 percent, have been on BLM-administered mineral estate. Twenty-five wells (0.25 percent) have been drilled on USFS-managed lands. An additional 3,770 wells (38 percent) have been drilled on private and state-owned oil and gas mineral ownership. At the close of 2008, there were 4,544 active oil and gas wells in the Planning Area (BLM 2009d).

There was an upward trend in Application for Permit to Drill (APD) approvals in the Planning Area between 2002 and 2005, peaking in 2005, when 378 APDs were approved (164 of which were on BLM-administered lands) (WOGCC 2009). APD approvals remained relatively steady from 2006 to 2008, averaging 104 approvals per year, but well below the 2005 peak. The number of APD submissions decreased further in 2009, likely driven by market conditions for oil and natural gas.

Table 3-13. Well Statistics by County for the Planning Area, as of June 2008

Statistic	Federal	Fee or State	Total
Big Horn County			
Number of Plugged and Abandoned Wells	849	842	1,691
Number of Dormant Wells	39	65	104
Number of Completed Wells	287	256	543
Number of Monitoring Wells	0	18	18
Notice of Intent to Abandon	7	11	18
Number of Spuds	5	16	21
Number of Expired Permits	60	35	95
Number of Permits To Drill	3	9	12
Permits Issued	1,250	1,252	2,502
Waiting On Approval	1	0	1
Total Permits (issued and pending)	**1,251**	**1,252**	**2,503**
Hot Springs County			
Number of Plugged and Abandoned Wells	936	537	1,473
Number of Dormant Wells	73	34	107
Number of Completed Wells	459	302	761
Number of Monitoring Wells	0	0	0
Notice of Intent to Abandon	11	1	12
Number of Spuds	33	9	42
Number of Expired Permits	58	51	109
Number of Permits To Drill	6	0	6
Permits Issued	1,576	934	2,510
Waiting On Approval	1	0	1
Total Permits (issued and pending)	**1,577**	**934**	**2,511**

Table 3-13. Well Statistics by County for the Planning Area, as of June 2008 (Continued)

Statistic	Federal	Fee or State	Total
Park County			
Number of Plugged and Abandoned Wells	886	611	1,497
Number of Dormant Wells	145	36	181
Number of Completed Wells	831	442	1,273
Number of Monitoring Wells	3	4	7
Notice of Intent to Abandon	9	6	15
Number of Spuds	77	25	102
Number of Expired Permits	127	75	202
Number of Permits To Drill	37	13	50
Permits Issued	2,115	1,212	3,327
Waiting On Approval	0	1	1
Total Permits (issued and pending)	**2,115**	**1,213**	**3,328**
Washakie County			
Number of Plugged and Abandoned Wells	624	104	728
Number of Dormant Wells	35	5	40
Number of Completed Wells	378	62	440
Number of Monitoring Wells	0	0	0
Notice of Intent to Abandon	12	3	15
Number of Spuds	8	5	13
Number of Expired Permits	74	12	86
Number of Permits To Drill	4	0	4
Permits Issued	1,135	191	1,326
Waiting On Approval	0	0	0
Total Permits (issued and pending)	**1,135**	**191**	**1,326**

Source: WOGCC 2009

Oil and Gas Production in the Planning Area

Oil and gas occurs in the Planning Area in numerous geologic formations, and members of formations that range in age from the oldest producing formation, the Flathead Sandstone (Cambrian age), through the youngest formation, the Fort Union (Tertiary age). Table 3-14 lists oil- and gas-producing formations and zones in the Planning Area through December 2008. In some formations, hydrocarbons are produced from more than one zone. The corresponding formations can be found in the stratigraphic chart (Figure 3-17) in Section 3.1.2 *Geologic Resources*. Cumulative production through 2008 in the Planning Area was approximately 2,168,185,301 thousand cubic feet of gas and 2,869,788,177 barrels of oil. The most prolific oil-producing formations have been the Phosphoria Formation and Ten Sleep Sandstone. The Madison has produced the third largest quantity of oil. A large amount of gas production has also been associated with the Phosphoria Formation, the Ten Sleep Sandstone, and within the Frontier Formation.

Table 3-14. Productive Zones in the Planning Area (through December 2008)

Producing Zone/Formation	Fields	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Amsden	15	5,446,804	17,239,333	55	47	102
Amsden-Madison	3	63,250	7,704,323	22	9	31
Amsden/Phosphoria	1	0	90	1	0	1
Big Horn	2	328,738	7,887,032	10	4	14
Chugwater	3	111,136,829	208,143	17	52	69
Cloverly	30	37,091,000	1,458,953	50	28	78
Cody	4	417,958	100,119	7	1	8
Coverly/Mowry	1	58,357	39,133	0	1	1
Crow Mountain	1	12,829	287,645	13	0	13
Crow Mountain-Phosphoria-Ten Sleep	1	0	2,081	1	0	1
Darby	3	3,734	30,257	4	1	5
Devonian	1	18,203	119,266	4	0	4
Dinwoody	2	0	628,973	49	0	49
Dinwoody/Phosphoria/Ten Sleep/ Amsden/Madison	1	0	3,220,368	10	33	43
Dinwoody-Phosphoria	3	13,784	2,464,787	16	8	24
Dinwoody-Phosphoria-Ten Sleep	1	0	25,866	2	1	3
Flathead	1	2,464,282	40,192	3	2	5
Fort Union	4	791,051	0	7	1	8
Fort Union-Lance	2	75,379	0	0	2	2
Frontier	88	677,344,620	88,171,606	793	428	1,221
Frontier-Cloverly	1	130,560	11,425	2	0	2
Frontier/Muddy	3	29,561,414	234,612	3	12	15
Gros Venture	1	4,687,895	36,530	1	2	3
Lance	3	452,241	5,658	2	2	4
Lewis/Mesaverde	1	3,250	0	1	0	1
Madison	21	152,110,544	359,644,999	360	392	752
Madison/Amsden	1	0	20,469	0	1	1
Madison/Amsden/Ten Sleep	4	5,036	373,837	1	4	5
Madison/Ten Sleep	4	1,119	1,049,110	7	7	14
Meeteetse	3	1,262,763	1,228	1	9	10
Mesaverde	6	5,089,224	99,028	9	16	25
Morrison	5	955,610	148,735	10	1	11
Mowry	6	1,474,326	276,963	24	15	39
Mowry/Frontier	3	1,626,429	167,008	0	3	3
Muddy	25	118,716,719	1,509,001	52	64	116
Muddy/Cloverly	2	385,731	21,085	1	1	2
Muddy/Frontier	1	133,703	7,805	0	1	1

Table 3-14. Productive Zones in the Planning Area (through December 2008) (Continued)

Producing Zone/Formation	Fields	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Phosphoria	120	559,517,419	976,280,423	1,443	1,543	2,986
Phosphoria/Ten Sleep	27	19,848,843	260,501,835	248	226	474
Phosphoria/Ten Sleep/Amsden	2	8,335	123,550	1	1	2
Phosphoria/Ten Sleep/ Amsden/Madison	2	36,625	451,433	0	7	7
Phosphoria/Ten Sleep/Madison	1	47,575	232,637	1	2	3
Precambrian	1	31,234	0	1	0	1
Sundance	16	8,341,739	73,371,516	209	62	271
Teapot	1	0	163	1	0	1
Ten Sleep	62	428,077,091	1,063,488,792	1,098	1,307	2,405
Ten Sleep/Amsden	4	14,655	412,160	1	5	6
Ten Sleep/Phosphoria/Dinwoody	1	0	22	1	0	1
Unknown	2	398,403	1,689,986	2	0	2
Totals		**2,168,185,301**	**2,869,788,177**	**4,544**	**4,301**	**8,845**

Source: IHS Energy Group 2009

There are 137 named fields and 1 unnamed field in the Planning Area (Table 3-15) (Map 26). There are eight major producing oil fields in the Planning Area (by volume), with production of 130 to 590 million barrels of cumulative oil production. These fields are, in descending order, the Oregon Basin, Elk Basin, Hamilton Dome, Grass Creek, Garland, Little Buffalo Basin, Frannie, and Byron. There are six major producing gas fields in the Planning Area, with production of 151 to more than 408 Bcf of cumulative gas production. In descending order, they are Worland, Elk Basin, Oregon Basin, Hamilton Dome, Garland, and Little Buffalo Basin.

Table 3-15. Producing Fields within the Planning Area (through December 2008)

Field Name	Producing Zones	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Adam	2	0	119,588	1	1	2
Alkali Anticline	4	159,893	2,862,004	28	12	40
Aspen Cree	1	0	341,678	4	0	4
Badger Basin	2	7,253,556	3,699,785	12	9	21
Baird Peak	1	0	469,211	1	1	2
Banjo Flats	1	3,808	34,696	1	0	1
Bearcat	7	1,649,457	846,138	4	9	13
Big Polecat	4	16,221,497	6,236,269	18	10	28
Black Mountain	6	104,512	21,925,035	24	52	76
Blue Springs	1	525	1,636	1	0	1
Bonanza	2	0	43,899,199	25	16	41
Boulder Gulch	1	148,987	84,485	4	0	4
Bud	1	0	13,863	1	0	1

Table 3-15. Producing Fields within the Planning Area (through December 2008) (Continued)

Field Name	Producing Zones	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Buffalo Rim	1	0	3,373	1	0	1
Byron	9	10,004,560	130,898,136	143	115	258
Byron South	1	4,434,390	42,519	1	0	1
Byron Southeast	2	655,689	135,520	4	0	4
Centennial	1	0	84,116	1	4	5
City	1	0	311	1	0	1
Cody	3	279,412	8,626,740	28	29	57
Coon Creek	2	159,840	168,353	3	4	7
Cottonwood Creek	6	66,892,025	60,028,218	109	198	307
Cottonwood Creek South	1	0	14	1	0	1
Coulee	2	279,422	18,329	2	1	3
Cowley	1	0	931,755	3	2	5
Crystal Creek	3	0	20,532	6	1	7
Danker North	5	2,819,760	1,149,009	9	4	13
Deaver North	1	146	1,566,094	3	9	12
Dickie	1	0	36,340	2	0	2
Dobie Creek	3	17,970,481	359,120	6	7	13
Doctor Ditch	2	794,669	49,391	2	0	2
Elk Basin	18	387,899,398	499,334,538	245	283	528
Elk Basin South	9	36,197,273	24,973,266	41	29	70
Emblem	1	542,230	5,651	1	1	2
Enigma	1	0	3,432,292	2	20	22
Enos Creek	4	402,225	289,810	10	1	11
Ferguson Ranch	2	31	5,186,274	5	12	17
Five Mile	7	52,325,845	1,364,026	14	26	40
Flashlight	1	0	98,202	1	0	1
Foster Gulch	2	0	17,315	2	0	2
Fourbear	7	279,989	40,526,593	179	64	243
Fourteen Mile	4	1,581,228	175,767	3	4	7
Franks Fork	1	0	2,081	1	0	1
Frannie	5	1,091,967	136,543,590	136	81	217
Freedom	1	0	27,694	0	1	1
Frisby South	2	5,855,515	7,379,642	22	24	46
Fritz	2	1,522,500	94,090	2	1	3
Garland	26	163,580,431	205,015,262	344	321	665
Garland South	2	1,343,934	6,460,395	4	0	4
Gebo	4	1,018,991	34,426,393	135	49	184
Golden Eagle	9	1,255,225	9,028,188	18	7	25
Goose Egg	1	13,372	131,089	2	4	6

Table 3-15. Producing Fields within the Planning Area (through December 2008) (Continued)

Field Name	Producing Zones	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Gooseberry	4	215,076	12,927,564	29	33	62
Grass Creek	23	15,503,950	269,309,750	761	370	1,131
Grass Creek South	1	0	10,808	1	0	1
Greybull	2	293	640,359	48	5	53
Greybull West	3	1,237,718	68,543	1	2	3
Half Moon	3	744,477	13,001,587	72	27	99
Hamilton Dome	14	265,434,111	293,140,149	278	307	585
Hand Creek	1	0	181,254	1	2	3
Heart Mountain	2	51,657,553	113,866	5	14	19
Hidden Dome	7	414,718	9,987,965	39	26	65
Homestead	1	30	1,953,450	10	4	14
Hunt	3	0	842,423	6	3	9
King Dome	3	1,274	391,351	9	1	10
Kirby Creek	2	554,782	1,720,414	9	29	38
Kirby Creek East	1	0	1,291	1	0	1
Lake Creek	4	31,282	7,640,419	18	23	41
Lamb	5	521,093	1,221,804	16	3	19
Lite Butte	2	0	465,493	1	3	4
Little Buffalo Basin	8	151,557,087	168,629,557	318	233	551
Little Grass Creek	5	13,092,748	213,499	3	4	7
Little Polecat	4	1,307,425	819,003	8	3	11
Little Sand Draw	5	396,802	12,110,782	41	13	54
Lovell Draw	1	0	860	1	0	1
Manderson	7	47,603,392	4,007,116	82	53	135
Marshall	1	24,779	701,148	4	5	9
McCulloch Peak	2	749,788	1,867	2	0	2
Meeteetse	5	35,109,102	465,097	10	16	26
Middle Dome	2	2,811	389,284	4	2	6
Murphy Dome	3	26,881	38,381,717	28	39	67
Neiber Dome	6	238,073	702,770	7	4	11
No Water Creek	2	481,939	4,162,667	25	10	35
Northline	2	27,768	3,401	2	0	2
Nowood	2	8	999,210	11	3	14
Nowood Southeast	1	7,238	242,836	2	6	8
Oregon Basin	16	304,132,678	590,084,882	362	954	1,316
Oregon Basin South	2	0	0	2	0	2
Oregon Basin Southeast	4	8,808,554	2,814	4	4	8
Oregon Basin West	2	143,610	802,410	2	4	6
Packsaddle	1	260,596	418,158	1	2	3

Table 3-15. Producing Fields within the Planning Area (through December 2008) (Continued)

Field Name	Producing Zones	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Penney Gulch	1	204	0	1	0	1
Pistol	1	5,918	9,069	2	0	2
Pitchfork	5	2,341,961	54,912,466	39	122	161
Prospect Creek	1	12,829	287,645	13	0	13
Pullium	3	8,372	5,117	3	0	3
Ralston	2	318,404	100,705	3	0	3
Rattlesnake	1	6,490,144	6,897,674	28	24	52
Rawhide	1	0	121,879	0	4	4
Red Springs	3	0	21,185	13	7	20
Rose Creek	2	0	99,624	5	0	5
Sage Creek	2	50	13,526,646	14	24	38
Sage Creek West	1	54,469	1,316,421	8	6	14
Sagebush	1	0	16,517	1	1	2
Sand Creek	2	0	438	2	0	2
Seller Draw	2	3,385,929	1,938	1	1	2
Sheep Point	1	9,846	590,046	3	3	6
Shoshone	4	38,268	4,832,776	30	17	47
Shoshone North	5	6,990	308,553	10	0	10
Siddon	1	0	60,151	3	0	3
Silver Tip	9	32,880,103	5,540,377	30	69	99
Silver Tip South	5	640,245	176,514	11	1	12
Skelton Dome	1	57,850	2,159	1	0	1
Slick Creek	4	9,620,887	6,340,130	41	15	56
South Fork	3	136,626	1,428,697	9	2	11
Spence Dome	2	2,352	1,060,644	27	50	77
Spring Creek	1	959	80,410	0	1	1
Spring Creek South	16	3,535,202	29,872,887	74	96	170
Sunshine North	5	0	4,332,341	16	33	49
Sunshine South	3	0	628,870	6	0	6
T E Ranch	3	1	217,007	5	1	6
Terry	2	766,513	22,180	1	2	3
Torchlight	7	6,412,788	16,474,302	80	32	112
Trench	1	0	40	1	0	1
Tuffy	2	91,168	98,920	2	1	3
Tumbler Ridge	1	0	6,989	4	0	4
Unnamed	10	1,684,786	210,095	10	5	15
Wagonhound	2	9,521	317,490	3	1	4
Walker Dome	5	1,251,818	5,051,159	17	11	28
Warm Springs	1	3,950	4,815,107	89	92	181

Table 3-15. Producing Fields within the Planning Area (through December 2008) (Continued)

Field Name	Producing Zones	Cumulative Gas (thousand cubic feet)	Cumulative Oil (barrels)	Inactive Wells	Active Wells	Total Wells
Water Creek	1	0	210,723	3	0	3
Waugh	1	0	355,393	1	3	4
Whistle Creek	6	3,430,583	4,818,206	25	2	27
Whistle Creek South	2	1,124,597	741	3	0	3
Wildhorse Butte	1	0	508	3	0	3
Wiley	1	153,745	81,127	1	3	4
Willow Draw	4	13,783	2,417,118	18	8	26
Worland	7	408,660,331	5,525,268	39	44	83
Zimmerman Butte	5	3,690	672,742	5	1	6
Totals	**N/A[1]**	**2,168,185,301**	**2,869,788,177**	**4,544**	**4,301**	**8,845**

Source: IHS Energy Group 2009

[1]Not applicable. Producing zones are not additive.

Since a production high during 1978, the rate of oil production in the Planning Area has steadily declined, with only a few short periods when production rates were flat. The rate of gas production declined from 1974 to 1983 and essentially flattened until 1989. The overall rate then increased until 1998, after which there was a decline in production rates. In 2008, oil production was at its lowest rate for the period from 1974 through 2008, and gas production was near its lowest rate for the same period (BLM 2014a).

Increases in production have occurred in some older oil fields within the Planning Area through different types of enhanced oil recovery projects. Enhanced oil recovery involves the injection of fluids (e.g., water, surfactants, polymers, or carbon dioxide) or sources of heat (steam or hot water) to stimulate hydrocarbon flow and move hydrocarbons that were bypassed in earlier recovery phases. Water floods have been the predominate method of increasing oil recovery and fewer floods of different types have been used. As of 2010, there were 46 active secondary recovery projects, 24 inactive projects, and 3 terminated projects in 37 total units/fields (BLM 2014a). Table 3-16 summarizes past and recent oil and gas production rates for counties in the Planning Area.

Table 3-16. Oil and Gas Production Rates for Counties in the Planning Area

County	Oil Production (barrels per month)[1]		Gas Production (thousand cubic feet per month)	
	1997	2007	1997	2007
Big Horn	309,385	169,654	547,594	242,199
Hot Springs	262,357	264,794	44,223	44,113
Park	868,917	707,279	1,105,218	1,211,575
Washakie	199,958	65,578	577,232	237,338

Source: WOGCC 2009

[1]Oil production is reported in barrels of 42 gallons each.

Coalbed Natural Gas

CBNG occurs in coal seams and may remain trapped where it was generated. The Bighorn Basin coalfield contains only minor amounts of coal compared to other Wyoming coal basins and is therefore not considered an important source of CBNG. Perhaps the single most limiting factor reducing the potential for CBNG resources in the Fort Union Formation is the apparent lack of thick, persistent coal in much of the basin (Roberts and Rossi 1999). Most of Wyoming's CBNG is produced from the Powder River Basin of northeastern Wyoming. According to WOGCC, no actual CBNG has been produced from any of the Bighorn Basin coals. In 2006, an attempt was made to produce CBNG from several wells located on private surface and mineral estate; however, only water was produced (WOGCC 2008).

Coals in the Paleocene Fort Union Formation, and the Cretaceous Meeteetse and Mesaverde Formations are classified as sub-bituminous, and are estimated to contain 116 Bcf of CBNG as undiscovered resources (Roberts and Rossi 1999; USGS 2008b).

Fourteen CBNG wells have been drilled in the Planning Area on lands with privately owned surface and minerals; 13 of those have been plugged. The remaining well is currently shut-in (IHS Energy Group 2009). No CBNG has actually been produced from any of the wells drilled in the Planning Area.

Carbon Dioxide Sequestration

Carbon dioxide is produced in association with natural gas production in several oil producing reservoirs in the Planning Area. Oil and gas reservoirs, unminable coal seams, and saline formations, all of which are present in the Planning Area, have been identified as potential carbon dioxide sequestration sites (DOE 2008). These sites could provide underground storage for carbon dioxide from natural gas production and other sources, such as power plants. There are currently no carbon dioxide injection enhanced recovery projects in the Planning Area or a pipeline for carbon dioxide transportation. The uncertain economic and technical aspects associated with carbon sequestration activities make it difficult to forecast future development. See *Reasonable Foreseeable Development Scenario for Oil and Gas, Bighorn Basin Planning Are*a for additional information on carbon sequestration in the Planning Area (BLM 2014a).

Oil and Gas Reserve/Resource Estimates

Oil and gas resources have high potential for occurrence throughout most of the Planning Area, with lower potential around the fringes (BLM 2014a). Table 3-17 lists projections of the amount of oil, gas, and natural gas liquid resources in the Planning Area for conventional and continual assessment units. It is estimated that the Planning Area contains a mean undiscovered volume of approximately 62.05 million barrels of oil, approximately 913.23 Bcf of gas, and 12.05 million barrels of natural gas liquids (in the two assessment units with projected hydrocarbon volumes). The Planning Area's oil resource could range from 16.51 to 124.99 million barrels, the gas resource could range from 293.61 to 1,879.61 Bcf, and natural gas liquids resource could range from 2.63 to 25.95 million barrels. For a more detailed description of the methodology behind these estimates, see the *Reasonable Foreseeable Development Scenario for Oil and Gas, Bighorn Basin Planning Area* (BLM 2014a).

Table 3-17. United States Geological Survey Undiscovered Conventional and Continuous Resources of Assessment Units in the Planning Area

Assessment Unit	Percent of Unit within Planning Area	Oil (mmb)			Gas (Bcf)			Natural Gas Liquids (mmb)		
		95%[1]	*5%*	*Mean*	*95%*	*5%*	*Mean*	*95%*	*5%*	*Mean*
Paleozoic-Mesozoic Conventional Oil and Gas	84.10	10.93	92.51	45.41	46.26	377.61	183.34	0.84	15.14	7.57
Cretaceous-Tertiary Conventional Oil and Gas	89.52	3.58	21.48	11.64	55.10	390.31	197.84	1.79	8.95	4.48
Muddy-Frontier Sandstone and Mowry Fractured Shale Continuous Gas	100.00	-	-	-	119.00	743.00	348.00	0.00	1.00	0.00
Mowry Fractured Shale Continuous Oil	100.00	2.00	11.00	5.00	1.00	6.00	2.00	0.00	0.00	0.00
Cody Sandstone Continuous Gas	100.00	-	-	-	14.00	80.00	38.00	0.00	0.00	0.00
Mesaverde Sandstone Continuous Gas	100.00	-	-	-	13.00	63.00	32.00	0.00	0.00	0.00
Mesaverde-Meeteetse Formation Continuous Coalbed Gas	85.52	-	-	-	62.50	167.62	83.81	0.00	0.86	0.00
Fort Union Formation Continuous Coalbed Gas	88.26	-	-	-	12.36	52.07	28.24	0.00	0.00	0.00
Total Undiscovered Resources	**-**	**16.51**	**124.99**	**62.05**	**323.22**	**1,879.61**	**913.23**	**2.63**	**25.95**	**12.05**

Source: USGS 2008b

[1]Estimates of recoverable resources for each oil and gas assessment unit area within the province and within the Planning Area, are presented as a range of possibilities: a low case having a 95 percent probability of that amount or more occurring, a high case having a 5 percent probability of that amount or more occurring, and a mean case representing an arithmetic average of all possible outcomes.

Bcf billion cubic feet
mmb million barrels

Projected Oil, Gas, and Coalbed Natural Gas Drilling Activity

For a baseline unconstrained RFD projection (limiting factors such as lease stipulations or the possibility that some areas might not be administratively available for leasing are not considered at this stage of analysis), it is estimated that during the 20-year planning cycle of 2008 through 2027, as many as 1,865 wells could be drilled in the Planning Area. Up to 150 of these wells could be CBNG wells. As many as 175 of the conventional wells could be deep wells (defined here as wells more than 15,000 feet deep) in the central portion of the Bighorn Basin (BLM 2014a).

Development potential is defined as high, moderate, low, very low, and none. Note that development potential is evaluated based on a broader range of factors then occurrence potential, which only considers the presence or absence of oil and gas resources regardless of the economic viability of

development. It is estimated that average drilling densities per township (one township is about 36 square miles) during the planning cycle will be:

- High: 100 or more wells
- Moderate: 20 to 100 wells
- Low: 2 to fewer than 20 wells
- Very Low: fewer than 2 wells
- None: no wells

Development potential classifications for oil and gas and coalbed natural gas in the Planning Area are shown in Table 3-18, based on projections in the *Reasonable Foreseeable Development Scenario for Oil and Gas, Bighorn Basin Planning Are*a (BLM 2014a).

Table 3-18. Oil and Gas Development Potential in the Planning Area

Development Potential	Oil and Gas[1]		Coalbed Natural Gas[2]	
	Acres	*Percent of Planning Area*	*Acres*	*Percent of Planning Area*
High	0	0	0	0
Moderate	344,736	8.2	0	0
Low	1,793,204	42.6	578,635	13.7
Very Low	1,819,780	43.3	1,388,845	33
None	106,242	2.5	2,095,570	49.8
Not Assessed	143,587	3.4	143,499	3.4
Total	**4,207,549**	**100**	**4,207,549**	**100**

[1]BLM 2013a
[2]BLM 2014a

Oil and gas drilling activity is projected to be concentrated in several locations in the Planning Area, including:

- In and around the Elk Basin and Garland fields in the northern portion in the Planning Area.
- In, around, and east of Oregon Basin Field near the City of Cody.
- Around Fritz Field in the east-central portion of the Planning Area.
- In and around several smaller, isolated fields around the margins of the basin.
- In additional scattered townships where moderate levels of activity are projected.

Most of these fields are densely drilled. Many new wells in these areas will likely be drilled as infill or fringe wells in existing fields, or as reentries into existing wellbores. Some minor exploratory activity could occur just beyond field boundaries. Well spacing is projected to be variable, in the range of 20 to 160 acres (BLM 2014a).

Future well-drilling activity is likely to occur in association with: (1) enhanced oil recovery projects, which could include the addition of wells in and around existing, mature oil and gas fields or residual oil zones, or (2) the exploration of new oil and gas reserves away from existing, developed areas. Well densities will likely remain similar to current densities, with isolated townships having the potential for an increase in drilling density (BLM 2014a).

Numerous fields in the Planning Area have been identified as candidates for carbon dioxide enhanced oil recovery, including but not limited to Big Polecat, Frannie, and Murphy Dome (Nummedal et al. 2003; Advanced Resources International 2006). Carbon dioxide supply, pipeline infrastructure, technological considerations, and economic factors are major determinants of future enhanced oil recovery using carbon dioxide (BLM 2014a). The USGS has also identified the Mesaverde-Meeteetse Formation and Fort Union Formation coalbed gas assessment units as potentially productive for CBNG in the Planning Area. Only limited exploratory drilling for CBNG has occurred in the Planning Area. Based on available information, there are no current plans for CBNG development in the Planning Area. However, because there has been limited CBNG exploration in the recent past (though unsuccessful) and the Planning Area includes the two previously identified USGS CBNG assessment units, it is possible that limited exploration and development could take place during the life of the plan` (BLM 2014a).

Readers will find additional information on projected oil and gas activity, including potential sites for future enhanced oil recovery projects, in the Planning Area in the *Reasonable Foreseeable Development Scenario for Oil and Gas, Bighorn Basin Planning Are*a (BLM 2014a).

Oil and Gas Master Leasing Plans

The Master Leasing Plan (MLP) concept promotes a proactive approach to planning for oil and gas development. During the final preparation of the Draft RMP and Draft EIS, the BLM issued IM 2010-117 regarding MLPs to address oil and gas leasing in areas with resource values of concern.

RMPs make oil and gas planning decisions, such as areas closed to leasing, open to leasing, or open to leasing with major or moderate constraints (lease stipulations) based on known resource values. However, additional planning and analysis may be necessary prior to oil and gas leasing because of changing circumstances, updated policies, and new information. Criteria for determining whether such additional planning and analysis is warranted are provided in IM 2010-117 and summarized below. When such analysis is warranted, the MLP process is conducted through the National Environmental Policy Act (NEPA) process before lease issuance and may reconsider RMP decisions.

MLP preparation is required when all four of the following criteria are met:

- A substantial portion of the area to be analyzed in the MLP is not currently leased.
- There is a majority federal mineral interest.
- The oil and gas industry has expressed a specific interest in leasing, and there is a moderate or high potential for oil and gas confirmed by the discovery of oil and gas in the general area.
- Additional analysis or information is needed to address likely resource or cumulative impacts if oil and gas development were to occur where there are:
    - Multiple-use or natural/cultural resource conflicts;
    - Impacts to air quality;
    - Impacts on the resources or values of any unit of the National Park System, national wildlife refuge, or National Forest wilderness area, as determined after consultation or coordination with the NPS, the USFWS, or the USFS; or
    - Impacts on other specially designated areas.

An MLP analysis may also be completed under other circumstances at the discretion of the BLM.

In late 2010, several groups nominated areas for MLP analysis. The BLM evaluated the requests and found that none of the nominated areas met the criteria requiring MLP analysis (BLM 2010a). After

State Director review, three areas within the Planning Area were determined to warrant additional analysis; these areas are the Absaroka Front, the Fifteenmile area, and the Big Horn Front.

Oil and gas development potential and resources of concern in Master Leasing Plan areas are identified in Table 3-19.

Table 3-19. Oil and Gas Development Potential and Resources of Concern in Master Leasing Plan Analysis Areas

Topic	Absaroka Front	Fifteenmile	Big Horn Front
Total Acreage	**402,646**	**230,699**	**444,830**
Acres BLM-administered Mineral Estate Minerals	253,112	180,816	379,308
Acres Existing Leases (Map 7)	6,533	43,112	0
Occurrence Potential of Total Acreage (RFD Figure 40)	High – 259,242 Low – 142,720	High – 192,247	High – 361,170 Low – 60,194
Conventional Oil and Gas Development Potential of Total Acreage (RFD Figure 45)	Moderate – 5,380 Low – 102,773 Very Low – 293,768	Moderate – 18,216 Low – 174,031	Low – 277 Very Low – 360,891
Coalbed Natural Gas Development Potential of Total Acreage (RFD Figure 46)	Low – 5,400 Very Low – 8,108	Low – 70 Very Low – 192,177	0
Resources of Concern	Wildlife habitat and recreational settings	Recreational settings, geologic features, and LRP soils	Wildlife habitat and recreational settings

Source: BLM 2010a

BLM Bureau of Land Management
LRP limited reclamation potential
RFD Reasonable Foreseeable Development

Absaroka Front Master Leasing Plan Analysis Area

This area provides crucial habitat, ranges, and migration corridors for a diversity of wildlife. The Master Leasing Plan Analysis Area contains part of one of the longest known elk migration routes in North America. The natural character of the Absaroka Front also attracts a diversity of recreational users (BLM 2010a). The key management concerns in this area are big game habitat, migration corridors, and dispersed recreational opportunities.

Fifteenmile Master Leasing Plan Analysis Area

The Fifteenmile MLP Analysis Area lies in the center of the Bighorn basin, containing scenic qualities and remoteness. The area is a popular recreation destination due to the primitive to semi-primitive setting characteristics. The entire MLP Analysis Area is within the Willwood formation and weathering by wind and water has created a rugged landscape with badland features. These fragile soils create challenges for reclamation. Fragile soils and recreational opportunities are the key management concerns in the area (BLM 2010a).

Big Horn Front Master Leasing Plan Analysis Area

Big game species rely on lands along Big Horn Front for winter habitat. Recreational opportunities attract visitors from the surrounding communities and from outside the region due to the spectacular scenery, abundant wildlife, and exposed geologic formations (BLM 2010a). Big game habitat, migration corridors, and dispersed recreational uses are the key management concerns in this area.

Management Challenges

A variety of management challenges for oil and gas exploration and development are associated with both public and internal BLM issues. Oil and gas development has a variety of beneficial and adverse impacts, which create a host of management challenges. Due to the breadth and depth of these management challenges, this section provides only a summary. The following is a partial list of known and potential management challenges for oil and gas exploration and development in the Planning Area:

- Processing timeframes for APDs and notices to perform seismic exploration.
- Timing restrictions on oil and gas leases, NOI to perform geophysical exploration, and APDs.
- Potential Endangered Species Act (ESA) listing of wildlife species such as the greater sage-grouse and how such listing would affect oil and gas development.
- Processing timeframes for ROW applications.
- Road design requirements.
- Lessee's/operator's surface-use rights.
- Impacts to wildlife and threatened and endangered species from oil and gas development and seismic exploration activities.
- Impacts to grazing permittees and lessees from oil and gas development and seismic exploration activities.
- Impacts to visual resources and cultural resources from oil and gas development and seismic exploration activities.
- Impacts to air and water quality from oil and gas development and seismic exploration activities.
- Impacts to soils and vegetation from oil and gas development and seismic exploration activities.
- Impacts to climate change from levels of CO_2 in the atmosphere from oil and gas development.
- Multiple-use conflicts resulting in restricted access to oil and gas resources.
- Economic impacts to local, state and federal governments from oil and gas production in the Planning Area.
- Split-estate issues.
- Staffing and priority to complete oil and gas workload.

3.2.6 Leasable Minerals – Other Solid Leasable Minerals

Other solid leasable minerals are those solid minerals, other than coal and oil shale, leased under the Mineral Leasing Act of 1920 and not related to energy production. Examples of other solid leasable minerals are phosphate, chloride minerals, SO_4 minerals, carbonate minerals, silicate minerals, borate minerals, and other "hardrock minerals." Hardrock (locatable) minerals on acquired public lands open to mineral leasing can be developed only under a leasing system. Access to other solid leasable minerals on federal estate is at BLM discretion.

No other solid leasable minerals are being leased or produced in the Planning Area. Other solid leasable minerals found in the Bighorn Basin are not currently considered economically viable to produce. Future demand for other solid leasable minerals will likely increase over time in parts of Wyoming and the west, but this is not anticipated to result in any new leasing or production in the Planning Area.

Management Challenges

The BLM has not identified management challenges for other solid leasable minerals.

3.2.7 Salable Minerals

Salable minerals, also known as mineral materials, include common varieties of sand, stone (such as decorative stone), gravel, pumice, clay, rock and petrified wood. These non-energy-related materials are typically used in construction, agriculture, and decorative applications. Under the BLM mineral materials program (43 CFR 3600), the BLM manages exploration, development, and disposal of salable minerals by sale (disposal) or free use. Recreational collection of this material is allowed, but large-volume removal requires a mineral sale. The BLM does not sell salable minerals at less than fair market value. Salable minerals in the Planning Area are an important component of the regional economy.

The Planning Area contains a variety of geological features and landforms that give rise to a diverse assortment of salable minerals. The primary salable minerals found in commercial quantities in the Planning Area are sand and gravel (aggregate), limestone, and decorative/construction stone (sandstone or limestone). Other salable minerals known to occur in the Planning Area in lesser quantities include flagstone and petrified wood.

Sand and gravel deposits consist of durable rock fragments (pebbles, cobbles) and particles. They are the result of bedrock that has been weathered and broken down into fragments that have been subsequently transported and deposited. Alluvial sand and gravel, terrace sand and gravel, and conglomeratic sand and gravel deposits are all found in the Bighorn Basin (Map 29).

As of April 2008, the CYFO and WFO had authorized a total of approximately 5 million cubic yards of sand and gravel disposals and 550,000 tons of rock disposals. The estimated annual production of salable minerals for the Planning Area is approximately 220,000 cubic yards per year (BLM 2008c). Map 8 shows the mineral materials sites in the Planning Area. Table 3-20 lists active community pits (16), free use permits (51), and contract sales (16) authorized in the Planning Area (by field office) as of January 1, 2009.

Table 3-20. Mineral Material Sites in the Planning Area

Operator/Permittee/ Pit Name	BLM Serial Number	Salable Mineral	Location
Cody Field Office Mineral Material Contracts			
Nicholls & Lewis/BLM	WYW-111944	Limestone Quarry	Quarry on west side of Little Sheep Mountain southeast of Lovell, Wyoming; S2SE Sec 28, T56N R95W
Nicholson Dirt Contracting	WYW-160176	Sand and Gravel	Pit on Eagle Pass east of Cody, Wyoming
Mountain Construction	WYW-165827	Sand and Gravel	Pit north of the Shoshone River east of Lovell, Wyoming
Frank Heiser	WYW-164329	Flagstone	Small sale southeast of Lovell, Wyoming
Frank Heiser	WYW-165847	Sand and Gravel	Small sale east of Lovell, Wyoming
L&M Excavation	WYW-165843	Sand and Gravel	Mineral material contract west of Cody, Wyoming
Cody Field Office Community Pits			
Windy Flats	WYW-084627	Sand and Gravel	NE Sec. 28, T52N 101W
Cowley	WYW-070870	Sand and Gravel	SESW Sec. 34, T58N R96W
Greybull	WYW-084713	Sand and Gravel	NWNE Sec. 7, T52N R93W
Northfork	WYW-123832	Sand and Gravel	NESW, N2SE Sec. 11, NWSE Sec. 12 T52N R104W
Frannie	WYW-089729	Sand and Gravel	N2SWNW Sec. 26, T58N R98W
Elk Basin	WYW-084714	Sand and Gravel	S2SE Sec. 20, T57N R99W
Eagle Pass	WYW-112058	Sand and Gravel	SENE Sec. 11, T52N R100W
Elk Basin Community Pit Expansion	WYW-165835	Sand and Gravel	S2SE Sec. 20, T57N R99W
Cody Field Office Free Use Permits			
Big Horn County	WYW-165887	Sand and Gravel	Crystal Creek Pit
Big Horn County	WYW-165888	Sand and Gravel	Greybull River Pit
Big Horn County	WYW-165889	Sand and Gravel	Table Mountain Southeast Pit
Big Horn County	WYW-165890	Sand and Gravel	Cody Pit
Big Horn County	WYW-165891	Sand and Gravel	Spence Pit
Big Horn County	WYW-165892	Sand and Gravel	Table Mountain Northwest Pit
Big Horn County	WYW-165893	Sand and Gravel	Greybull Cemetery Pit
Big Horn County	WYW-165894	Sand and Gravel	Yellowtail Causeway Pit
Big Horn County	WYW-165833	Sand and Gravel	Table Mountain Northwest expansion
Park County	WYW-165760	Sand and Gravel	Sheep Mountain Pit
Park County	WYW-165761	Sand and Gravel	New YU Bench Pit
Park County	WYW-165762	Sand and Gravel	Canyon Road Pit
Park County	WYW-119009	Sand and Gravel	Eagle Pass Pit – in reclamation
Park County	WYW-165763	Sand and Gravel	Lower Greybull Pit
Park County	WYW-165764	Sand and Gravel	Polecat Bench Pit

Table 3-20. Mineral Material Sites in the Planning Area (Continued)

Operator/Permittee/ Pit Name	BLM Serial Number	Salable Mineral	Location
Deaver Irrigation District	WYW-162990	Sand and Gravel	Issued from Park County FUP WYW-165764
Korean War Veterans Assn.	WYW-165844	Sand and Gravel	Issued from Windy Flats Community Pit
BLM CYFO	WYW-165828	Red Fill Material	Triassic Chugwater Formation Red Fill
BLM CYFO	WYW-165838	Sand and Gravel	Issued from Eagle Pass Community Pit
Town of Byron	WYW-165739	Sand and Gravel	N/A
Town of Byron	WYW-165740	Sand and Gravel	N/A
Town of Cowley	WYW-160170	Sand and Gravel	N/A
Town of Greybull	WYW-160162	Sand and Gravel	N/A
Sidon Canal Co.	WYW-119015	Sand and Gravel	N/A
Sidon Canal Co.	WYW-120878	Sand and Gravel	N/A
WYDOT	WYW-137818	Sand and Gravel	N/A
WYDOT	WYW-148687	Sand and Gravel	Exclusive pit on Eagle Pass east of Cody
WYDOT	WYW-157415	Sand and Gravel	Issued from Windy Flats Community Pit
WYDOT	WYW-142437	Sand and Gravel	N/A
WYDOT	WYW-165834	Sand and Gravel	Issued from Windy Flats Community Pit
Worland Field Office Mineral Material Contracts			
Dan Madden	WYW-159550	Sand and Gravel	SWSE Sec. 27, T46N R93W
Jerry Brown Constr.	WYW-159551	Sand and Gravel	NWSW Sec. 14, T47N R93W
McGarvin-Moberly	WYW-156317	Sand and Gravel	SWSE Sec. 11 and N2 Sec. 14, T47N R93W
Hunt Oil Co.	WYW-159559	Sand and Gravel	N/A
Big Horn RediMix	WYW-162887	Sand and Gravel	N/A
McGarvin-Moberly	WYW-165045	Sand and Gravel	NWSW Sec. 14, T47N R93W
Worland Field Office Community Pits			
Kirby	WYW-069560	Specialty Stone	NWSE Sec. 35, T45N R95W
Manderson	WYW-084781	Sand and Gravel	SWSE Sec. 28, T50N R89W
Worland	WYW-094069	Sand and Gravel	N2 Lot 2 Sec. 23, T47N R93W
Fox Mountain	WYW-094110	Moss Rock	SESW SWSE Sec. 11, T52N R92W
Sulphur Tract	WYW-123834	Sand and Gravel	N/A
Thermopolis	WYW-136132	Flagstone	E2NW W2NE Sec. 8, T42N R96W
Six-mile	WYW-137821	Sand and Gravel	N/A
Rome Hill	WYW-142389	Specialty Stone	Portions of Sec.'s 19, 20, 29, 30, 32, T47N R87W

Table 3-20. Mineral Material Sites in the Planning Area (Continued)

Operator/Permittee/ Pit Name	BLM Serial Number	Salable Mineral	Location
Worland Field Office Free Use Permits			
Hanover Canal Co.	WYW-138717	Sand and Gravel	N/A
Washakie County	WYW-142435	Sand and Gravel	N/A
Washakie County	WYW-142436	Sand and Gravel	N/A
Big Horn County	WYW-144844	Sand and Gravel	N/A
Washakie County	WYW-144861	Sand and Gravel	N/A
Washakie County	WYW-148812	Sand and Gravel	N/A
Washakie County	WYW-148813	Sand and Gravel	N/A
Washakie County	WYW-148814	Sand and Gravel	N/A
Washakie County	WYW-148815	Sand and Gravel	N/A
Washakie County	WYW-150999	Sand and Gravel	N/A
Big Horn County	WYW-153881	Sand and Gravel	N/A
Hot Springs County	WYW-153882	Sand and Gravel	N/A
Hot Springs County	WYW-153883	Sand and Gravel	N/A
Washakie County	WYW-153916	Sand and Gravel	N/A
Washakie County	WYW-153918	Sand and Gravel	N/A
Washakie County	WYW-156315	Sand and Gravel	N/A
Hot Springs County	WYW-159540	Sand and Gravel	N/A
Big Horn County	WYW-159558	Sand and Gravel	N/A
Big Horn County	WYW-162889	Sand and Gravel	N/A

Source: BLM 2009d

BLM	Bureau of Land Management	N	north	Sec	section
Co.	Company	NE	northeast	SW	southwest
CYFO	Cody Field Office	NW	northwest	T	Township
E	East	R	Range	W	west
FUP	free use permit	S	south	WYDOT	Wyoming Department of Transportation
N/A	not applicable	SE	southeast		

As of June 2008, disturbances related to various types of salable mineral disposals in the Planning Area totaled 3,760 acres (BLM 2008a). This includes disturbances from free use permits totaling approximately 1,780 acres, from community pits totaling 1,630 acres, and from noncompetitive contract sales totaling 345 acres (Map 8). Review of 2013 data indicated that disturbances from free use permits totaled approximately 1,719 acres, while community pits totaled 1,937 acres and noncompetitive contract sales totaled 154 acres (BLM 2013a).

With an increase in construction and general growth, nationwide demand for salable minerals is increasing, particularly in western states. Matching this trend, the Planning Area has seen an increase in the amount of salable minerals sold and in the number of contracts and requests for contracts for salable minerals. The Planning Area has seen an increase in the amount of inquiries related to obtaining decorative stone, “moss rock,” and field stone or boulders. These types of salable minerals are common

throughout Wyoming and the Planning Area, and are typically composed of sandstone, granite or limestone partially covered with colorful lichens (not moss), or not covered.

Large estimated quantities of salable mineral reserves are present in the Planning Area; therefore, a sustainable level of mineral resources is available to meet demand. The salable minerals industry working in the Planning Area has been able to sustain or increase its production in response to increasing demand for their product, despite fluctuating gas prices and occasional equipment and labor shortages.

Readers can find additional information about salable minerals in the Planning Area in the *Solid Mineral Occurrence and Development Potential Report* (BLM 2009d).

Management Challenges

Management challenges associated with disposal of salable minerals result from salable mineral mining activities. Salable mineral mining activities in areas close to housing create noise associated with equipment, odors associated with hot mix plants, and air quality concerns related to processing of salable minerals (chiefly involving dust or PM). Additional management challenges associated with salable mineral mining activities include impacts from surface disturbance; proximity of existing and potential mineral materials sites to important wildlife and their habitat, such as sagebrush and greater sage-grouse; and the impacts to sensitive species.

Construction/dimension stone or flat slabs of flagstone are not widely available in the Planning Area. One negotiated sale has been processed for a small quantity of thin lime flagstone from the Sundance Formation north of Greybull, Wyoming. However, demand for this material is up due to the increase in residential and commercial construction in Big Horn and Park counties. The BLM will likely need to identify additional sites on public lands during the next planning cycle to help meet this demand.

Illegal (unpermitted) trespass removal of mineral materials, including decorative stone, is an additional management challenge associated with salable minerals in the Planning Area. Another management challenge involves handling the demand, availability, and location of salable minerals in response to anticipated demand, both locally and nationally.

3.3 Fire and Fuels Management

Fire is an integral part of the ecological process of many plant communities in the Bighorn Basin. Several vegetation types in the basin have developed under a regime of intermittent fire and have adapted to the effects of fire in some way. Fire behavior within each vegetation type varies with many factors, including topography and site productivity. Highly productive sites, such as north slopes, generally have more biomass and, therefore, can carry fires better than less productive sites.

The BLM fire management program focuses on two categories of wildland fire – wildfires (previously referred to as unplanned ignitions) and prescribed fires (previously referred to as planned ignitions). The *Guidance for Implementation of the Federal Wildland Fire Policy* (USFS et al. 2009) directs BLM field offices to have a Fire Management Plan (FMP) for all areas with burnable vegetation that provides for firefighter and public safety; includes fire management strategies, tactics and alternatives; addresses values to be protected and public health issues; and is consistent with resource management objectives, activities of the area, and environmental laws and regulations. Within the Planning Area, the BLM manages wildfires and prescribed fires in accordance with the Northern Zone FMP (BLM 2004b).

The Planning Area is in the Big Horn Basin Fire Planning Unit. The Big Horn Basin Fire Planning Unit consists of the Bighorn National Forest, Shoshone National Forest, Wind River Indian Reservation, and the Bighorn Canyon National Recreation Area (BLM 2004b). The BLM has interagency cooperative agreements with the agencies responsible for managing these areas. The Cody Interagency Dispatch Center coordinates fire suppression operations (BLM 2004b).

In accordance with *Guidance for Implementation of Federal Wildland Fire Management Policy* (USFS et al. 2009), the BLM will continue interagency and local cooperation to set priorities for fire management planning, preparedness, prevention, suppression, use of wildland fire, restoration and rehabilitation, monitoring, research, and education. Interagency cooperation ensures accountability by instituting meaningful performance measures and monitoring results.

Table 3-21 lists the annual average number of acres of wildfires, prescribed fires, and mechanical and chemical treatments in the Planning Area. The acreage burned has been calculated as an annual average from 1981 to 2009 for both prescribed fires and wildfires. The BLM also modifies fuels with mechanical and chemical treatments in the Planning Area. The BLM did not use mechanical and chemical treatments to reduce fuel loads in the Planning Area until 2002, when the National Fire Plan began making funds available for these kinds of projects.

Table 3-21. Wildfires, Prescribed Fires, and Mechanical and Chemical Treatments in the Planning Area

	Wildfire	Prescribed Fire	Mechanical Treatment	Chemical Treatment
Average Acres Per Year	5,881	3,294	1,408	250

Source: BLM 2009i

The Fire Regime Condition Classification System (FRCC) classifies existing ecosystem conditions to determine priority areas for treatment (Table 3-22). The FRCC measures the vegetation's degree of departure from reference conditions, or how different the current vegetation condition is from a particular reference condition. This could result in changes to key ecosystem components such as vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated

disturbances (e.g., insect- or disease-related mortality). FRCC involves two pieces of information – (1) the historic fire regime and (2) the condition class. Fire regime is the inferred historic fire return interval and severity on a given landscape; condition class is the departure of the given area from the historic fire interval. Fire regimes in the Planning Area, by vegetation type, appear in the Northern Zone FMP (BLM 2004b). Information on fire regimes and the Northern Zone FMP is available at: http://www.blm.gov/wy/st/en/programs/Fire/planning.html.

Table 3-22. Fire Regimes

Group	Percent of Planning Area[1]	Frequency	Severity	Severity Description
I	2%	0 to 35 years	Low/mixed	Generally low-severity fires replacing less than 75% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
II	4%	0 to 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
III	9%	35 to 100 years	Mixed/low	Mixed-severity with less than 75% of the overstory vegetation replaced.
IV	45%	35 to 200 years	Replacement	High stand replacement-severity fires with greater than 75% of the dominant overstory vegetation replaced.
V	41%	200+ years	Replacement/any severity	High (stand replacement) severity.

Source: DOI and the Nature Conservancy 2008

[1]The percentages presented in this table are estimates only and due to rounding add up to more than 100 percent.

Condition class describes ecosystem health as follows:

- ***Condition Class 1***. For the most part, fire regimes in this Fire Condition Class are within historical ranges. Vegetation composition and structure are intact. Therefore, the risk of losing key ecosystem components from the occurrence of fire remains relatively low.
- ***Condition Class 2***. Fire regimes on these lands have been moderately altered from their historical range by increased or decreased fire frequency. A moderate risk of losing key ecosystem components has been identified on these lands.
- ***Condition Class 3***. Fire regimes on these lands have been substantially altered from their historical return interval. The risk of losing key ecosystem components from fire is high. Fire frequencies have departed from historical ranges by multiple return intervals. Vegetation composition, structure, and diversity have been substantially altered. Consequently, these lands have the greatest risk of ecological collapse.

The Planning Area is broken up into five Fire Management Units (FMUs) – Absaroka Front, Basin Bottom, Foothills Sagebrush, Nowater, and West Slope Bighorn. An FMU is a geographic area with similar plant communities and resource and fire management objectives. Detailed descriptions of the five FMUs appear in the Northern Zone FMP (BLM 2004b). For example, portions of the Nowater, Foothills Sagebrush, and the lower elevations of the West Slope Bighorn FMUs have extensive areas of cheatgrass invasion in burned and unburned areas that are important greater sage-grouse habitat. BLM fire managers have learned that wildland fires in these FMUs often experience extreme rates of spread and can be difficult to control. Thousands of acres that burned in the 1996 wildfires in these FMUs are now occupied by cheatgrass with little or no sagebrush present. In an effort to protect the remaining

sagebrush/bunchgrass plant communities, the management prescription for these FMUs calls for aggressive fire suppression and rehabilitation of burned areas. In contrast, higher-elevation areas in the West Slope Bighorn FMU employ less aggressive suppression techniques because of inaccessible rugged terrain and the largely beneficial effects of fire on plant communities and overall watershed condition. General management guidelines for fire suppression are found in the Northern Zone FMP (BLM 2004b).

Table 3-23 provides a coarse-scale landscape-level assessment of fire regime condition classes for the area covered by the Northern Zone FMP based on University of Wyoming GAP Analysis Program Data (University of Wyoming 1994), ground-truthing, Risk Assessment Mitigation Strategy (RAMS) data, and expert input. The Northern Zone FMP and maps are available at: http://www.blm.gov/wy/st/en/programs/Fire/planning.html. Based on this assessment, it was estimated that nearly 35 percent of the Planning Area is in FRCC Classes 2 and 3.

Table 3-23. Acreages of Fire Regime Condition Classes in the Planning Area, 2007

Condition Class 1		Condition Class 2		Condition Class 3		Total Acres
Acres	*%*	*Acres*	*%*	*Acres*	*%*	
4,074,067	65	1,379,116	22	821,052	13	6,274,235

Source: BLM 2008a

Management Challenges

The challenges of fire and fuels management center on preventing wildfires and adequately addressing stabilization and rehabilitation efforts after wildfires. Fire size and frequency is likely to increase, due primarily to the spread of cheatgrass, but also due to mixed conifer forests affected by bark beetles and blister rust. The spread of cheatgrass, and the associated increase in wildfires, threatens greater sage-grouse and other sagebrush habitat-dependent species. Despite treatment efforts, cheatgrass has recently become more widespread and has extirpated native vegetation in some areas (BLM 2009a).

3.3.1 Wildfires (Unplanned Ignitions)

Between 1981 and 2009, lightning caused most of the wildfires in the Planning Area (118). The remaining fires were human caused (71) or, in a few cases, the cause of the fire was unknown (BLM 2004b).

Wildfires are unplanned ignitions and include fires that burn outside the parameters defined in land use plans and FMPs for that location under current and expected conditions, such as fires burning in areas where fire is specifically excluded; fires that exhibit burning characteristics (intensity, frequency, and seasonality) outside prescribed ranges, including fires expected to produce severe fire effects; and fires that occur during periods of high fire danger. Wildfires are typically caused by lightning, unauthorized and accidental human-caused action (e.g., arson, escaped camp fires, and equipment fires), or escaped prescribed fires.

However, a lightning-caused wildfire could still be used to meet fuels and ecosystem management objectives if:

- that type of fire is expected within the parameters of an approved plan;
- the fire is burning within the parameters for the area;
- the fire is not causing, or does not have the potential to cause, unacceptable effects; and,
- funding and resources to manage the fire are available.

A diversity of fuel types occur in the Planning Area, primarily because of its location in three physiographic areas (the Northern Shortgrass Prairie to the north and east, the Central Rocky Mountains on the west, and the Wyoming Basin south of and including the Planning Area). The Bighorn Basin is bounded by mountains on all sides; thus, there is a rain shadow effect in the basin bottom. This effect generally limits both wildfires and prescribed fires, except in river bottoms due to denser vegetation growth, by limiting the growth of vegetation to fuel wildland fires. Upslope from the basin bottom, fuel types and fire regimes are similar to those found in the Northern Shortgrass Prairie and Central Rocky Mountain physiographic areas, and nearly all wildfires and prescribed fires occur in these areas.

Table 3-24 lists the burned acres in the Planning Area from 1981 through 2009 for fires larger than 10 acres. During the same period, more than 4,000 acres in the Planning Area burned twice. It is noteworthy that these areas, which experienced no major fires since European settlement, have now burned twice since 1996; this is largely a result of an increase in vegetative ground cover, including cheatgrass, in these areas.

It is expected that the average number and size of wildfires will increase compared to the period from 1981 through 2009 in most of the Planning Area (BLM 2009a). It has been documented that cheatgrass is more widespread, especially in the Nowater FMU, than it was 25 years ago (BLM 2009a). In all likelihood, fire size and frequency will increase in areas affected by cheatgrass. Another area of concern is the mixed conifer forest with health issues caused by bark beetles and blister rust. The Northern Zone FMP provides a more in-depth history of wildfire occurrence in each FMU from 1981 through 2003, the years reviewed for that plan (BLM 2004b).

Table 3-24. Acres Burned and Ignitions for Fires Larger than 10 Acres in the Planning Area, 1981-2009

Year	Acres Burned	Total Number of Fires
1981	85	3
1982	513	5
1983	1,471	6
1984	134	2
1985	3,425	2
1986	0	0
1987	0	0
1988	3,800	7
1989	466	1
1990	213	2
1991	576	4
1992	780	3
1993	299	3
1994	2,494	14
1995	408	8
1996	110,016	25
1997	0	0
1998	401	3
1999	407	1
2000	18,266	9
2001	4,113	7
2002	1,396	8
2003	2,795	3
2004	482	8
2005	1,567	1
2006	5,003	9
2007	7,213	8
2008	558	7
2009	186	2
Total	**167,067**	**151**

Sources: BLM 2008d; Neighbors 2010.

Note: Fires have occurred in the Planning Area since 2009; however, the total burned acreage has not changed appreciably.

Changes in temperature and precipitation can lead to fluctuations in wildfire occurrence. A series of years with below normal temperatures and above normal precipitation usually leads to a decrease in the number and size of wildfires. However, seasonal and yearly variations in temperature and precipitation have different effects on different fuel types. For example, above normal spring precipitation can increase fire danger in areas dominated by cheatgrass and at the same time decrease fire danger in timber types. Higher temperatures could increase the size and intensity of fires in timber and woodland types. Below normal precipitation leading to sustained drought can actually decrease fire danger on some rangeland types due to lack of grass or fine-fuel production.

3.3.2 Prescribed Fires (Planned Ignitions)

Prescribed fire is used in a controlled manner for specific purposes, such as improving habitat and plant community health, and reducing hazardous fuels. The BLM manages the fire program in the Planning Area to protect public safety, life, and property, and uses both wildland fire and fuels treatments. Fire and fuels treatments are management tools to maintain or increase age-class diversity within plant communities (e.g., big sagebrush/grassland); rejuvenate fire-dependent plant communities (e.g., aspen and ponderosa pine); maintain or increase vegetation productivity, nutrient content, and palatability; and maintain or improve wildlife habitat, rangeland, and watershed condition. Fire is also a management tool for disposing of timber slash, preparing seedbeds, reducing hazardous fuels, controlling disease or insects, improving rangeland health, managing livestock grazing, thinning, or manipulating species in support of forest management objectives.

Though treated acres vary widely by year, fire-treated acres have generally declined in recent years in relation to peaks in the mid to late 1990s (prescribed fires) and early 2000s (mechanical treatments) (BLM 2009a).

Concerns about cheatgrass and greater sage-grouse habitat have decreased the feasibility of using prescribed fire in some areas. However, advances in mechanical and chemical vegetation treatment options are making those types of vegetation treatments more feasible.

3.3.3 Stabilization and Rehabilitation

The BLM implements long-term rehabilitation measures to repair land damaged by wildfire that is unlikely to recover naturally according to BLM Emergency Stabilization and Rehabilitation standards in the *BLM Burned Area Emergency Stabilization and Rehabilitation Handbook* (BLM 2007a). The BLM will implement rehabilitation measures for reasons such as preventing impacts to crucial fisheries habitat from erosion and sediment, preventing mass wasting onto private property, preventing the invasion of noxious weeds, and restoring a municipal watershed. Each FMU in the Northern Zone FMP has stated general objectives for stabilization and rehabilitation (BLM 2004b).

Emergency stabilization and burned-area rehabilitation are part of a holistic approach to addressing post wildland fire issues, which also includes repairing damage from suppression activities and long-term (more than 3 years) restoration. The incident management team begins the process by repairing damage from suppression activities. Emergency stabilization refers to Burned Area Emergency Response Team planned actions implemented within 1 year of wildfire containment to stabilize and prevent unacceptable degradation to natural and cultural resources; to minimize threats to life or property resulting from the effects of a fire; or to repair/replace/construct physical improvements necessary to prevent degradation of land or resources. Burned-area rehabilitation refers to efforts undertaken within 3 years of wildfire containment to repair or improve fire-damaged lands unlikely to

recover naturally to management-approved conditions, or to repair or replace minor facilities damaged by fire. The process concludes with long-term restoration.

From 1993 through 2009, wildfires burned 164,717 acres in the Planning Area. Of the burned acres, treatments, as stabilization or rehabilitation, include 9,726 acres of seeding, 331 acres of sagebrush seedling plantings, 182 acres of mechanical manipulation, and 19,131 acres of chemical application to decrease noxious and invasive weed distribution and density (BLM 2009a; Neighbors 2010). At present, despite chemical and seeding treatment, 57,000 acres of wildfire-burned areas have invasive, exotic cheatgrass present, some to the extent that native vegetation is extirpated (BLM 2009a).

3.4 Biological Resources

This section describes biological resources in the Planning Area. It describes the current condition of vegetation, invasive species and pest management, fish, wildlife, special status species, and wild horses. Because biological resources are complex and the Planning Area is large, this section does not attempt to provide an encyclopedic description of all vegetation, fish, wildlife, and special status species in the Planning Area. This section and the remainder of this document use common names for species. Appendix K provides a complete list of scientific names for species referenced in this document.

Information in this section is based on plant communities and cover types identified through the Wyoming Gap Analysis performed as part of the National Gap Analysis program between 1991 and 2012. The Wyoming Gap Analysis is the basis for vegetation types that will be used throughout this analysis. The Wyoming Gap Analysis is a product of the University of Wyoming. This data set contains land cover for the entire state of Wyoming at a 1:100,000 scale. This data is useful for providing a broad overview of vegetation resources in the Planning Area, and is suitable for planning purposes at the RMP level of analysis. Each vegetation type consists of several ecological sites.

Habitat Fragmentation

As large contiguous blocks of habitat are bisected into smaller blocks, they become isolated from one another by dissimilar habitats and land uses. For example, a contiguous 100,000-acre block of sagebrush habitat is considered fragmented when a major highway is constructed within the habitat, thereby bisecting the block. If, in this example, the highway bisects the 100,000-acre block in half, the result of this fragmentation is two 50,000-acre blocks of sagebrush habitat bisected by a highway. As blocks of habitat are repeatedly bisected into smaller blocks, there can be adverse impacts, including isolation, to individual plant and animal species and communities occupying the habitat (Freddy et al. 1986; WGFD 2000). Impacts to biological resources from habitat fragmentation can occur on multiple scales.

Actions that result in habitat loss are exacerbated when fragmentation reduces the size and/or isolates remaining habitat patches below size thresholds necessary to support particular species. For example, some large birds in the Planning Area have large territorial requirements, while some smaller birds in the Planning Area favor habitat areas larger than their territory. These species are area-sensitive, and habitat loss and fragmentation that reduces or isolates their area thresholds likely affects their distribution and abundance in the Planning Area.

With the passage of the Homestead Acts in the 19th Century, early European American settlement of Wyoming introduced people, trails, livestock, agriculture, irrigation, and energy development to the Planning Area, all of which contributed to changes in land management and habitat fragmentation. Subsequent development of the region in the early to mid1900s included the railroad and a road network to connect population centers. In the late 1900s, ever-increasing rural development of homes and recreational properties further fragmented habitats in the Planning Area. Animal/vehicle collisions resulting from increased traffic in these areas and the risk to private property from wildfire are both consequences and reminders of existing habitat fragmentation conditions within the Planning Area.

Linear features, including roads, railroads, trails, irrigation systems, and ROWs, fragment Planning Area habitat. The network of state highways, county roads, local roads on private and public lands, and railroads dissect much of the Planning Area. The development of irrigation reservoirs and districts with their associated water-distribution systems also has contributed to habitat fragmentation in the Planning Area. Irrigation water also has supported the conversion of native plant communities to

hayfields, pasture, and cropland, thereby further fragmenting habitats. Fences can block migration routes for some wildlife species, such as pronghorn, consequently fragmenting their habitats. The conversion of large acreages of sagebrush to predominately grassland communities can fragment habitat for sagebrush-dependent species such as the greater sage-grouse.

Habitat fragmentation in the Planning Area is most prevalent along the linear features identified in the previous discussion; however, fragmentation also occurs at population centers, reservoirs, and other developments where humans live, recreate, and work. For example, the development of private parcels bordering BLM-administered lands has, in some cases, contributed to habitat fragmentation by the conversion to subdivisions or smaller ranchettes. This type of land conversion and habitat fragmentation primarily occurs near the wildland-urban interface. Buildings, roads, fences, and utility corridors associated with residential and commercial developments have all contributed to habitat fragmentation in the Planning Area.

In addition to the linear features and other types of development, conditions on BLM-administered land continue to be influenced by the management of resources and resource uses, including mineral resources; fire and fuels management; forests, woodlands, and forest products; and land resources. Refer to the appropriate sections in this document for additional details regarding existing conditions of these resources and resource uses.

In general, development and the associated construction and maintenance of roads, railroads, well pads, pipelines, and powerlines has fragmented habitat in the Planning Area. In addition, prescribed fires and wildfires have sometimes contributed to temporary habitat fragmentation. Intense and large area burns can temporarily isolate individual species and communities of plants and less mobile species of animals. A frequent fire return interval often associated with invasive species can effectively fragment habitat over the long run. Similar to fire, the habitat fragmenting effects of mechanical vegetative treatments have generally been temporary. Motorized-vehicle use also can contribute to habitat fragmentation through the transportation of invasive species seeds.

Biological Diversity

The Keystone Center defines four elements of biological diversity related to scale (Keystone Center 1991):

- Genetic diversity
- Species diversity
- Community or ecosystem diversity
- Landscape or regional diversity

Biological diversity is complex, and makes the measurement of existing conditions difficult. Species diversity is the most recognizable and easily understood element of biological diversity and for this RMP revision is defined as the variety of species found in the Planning Area. In other words, species diversity includes the numbers and distribution of all species. This includes common and plentiful species (e.g., mule deer, elk, and pronghorn) and other less common or rare species (e.g., burrowing owl, mountain plover, and bald eagle). Classifying rare species as sensitive, threatened, or endangered is one way of conserving biological diversity because these classifications heighten awareness and ensure consideration in management actions for conservation of rare species.

Spatial and temporal scales also are important considerations for conserving biological diversity. For example, nonmigratory populations of mammals are sometimes temporarily diminished following a harsh winter and limited food supply. In addition, migratory birds might return to breeding grounds

with diminished populations due to the stress factors associated with migration. In these cases, the lower number of individuals of wildlife populations does not necessarily equate to a reduction in biological diversity because the number of individuals ultimately (all else being equal) return to pre-winter levels. For purposes of this RMP and EIS, the BLM considers permanent reductions in the four elements of diversity listed above to be adverse impacts to biological diversity.

Counting the number and relative frequency of species occupying an area over time is one means of identifying reductions in species diversity; however, this approach can be overly simplistic and does not necessarily address the other three elements of diversity. At present, there is no single commonly accepted scientific protocol for measuring biological diversity. Nevertheless, it is generally accepted that "… reducing the number of biological entities in a system or making some of them less abundant reduces diversity" (Langner and Flather 1994).

Climatic factors (e.g., drought) and disease, fire regime, predation, competition, and population cycles all have contributed to the current natural variability in number and relative frequency of individuals, species, and communities of plants and animals in the Planning Area. Other factors include surface-disturbing activities (e.g., road and well pad construction), the physical and chemical environment (e.g., soil nutrients and water), adjacent area vegetation (e.g., croplands), historic vegetation, invasive species, herbivory (e.g., native ungulates and livestock), and the Planning Area's existing vegetation.

Existing conditions for biological diversity in the Planning Area are a function of physical factors (e.g., soils, geology, air, water, geography, and elevation), natural factors (e.g., climate, fire, drought, disease, and evolution), and human actions. In the context of these physical and natural factors, biological diversity evolved over time to produce the diversity present in the Planning Area prior to European-American settlement. Human actions during the subsequent 150 years changed the pattern, composition, structure, and function of plant and animal communities in the Planning Area. Management challenges for biological diversity include competing resources and resource uses. Management actions to address these challenges are incorporated in the alternatives for physical and biological resources and for fire and fuels management (see Chapter 2).

Vegetation Resources

Climate, geology, soils, elevations, precipitation patterns, and other physical and biological features associated with ecological setting influence the types and mixes of vegetation in the Planning Area. The types and mixes of vegetation in the area form the base for ecosystem processes and functions, such as water cycling, energy capture and cycling, and nutrient cycling, that produce the products and services local, regional, national, and international communities desire. Some of the desirable products and services vegetation supports include clean water, fish and wildlife habitat, livestock forage, recreation, carbon sequestration, and scenery.

As described in Section 3.1.3 *Soil*, the Planning Area lies within two MLRAs: the Northern Intermountain Desertic Basins – 32, (5- to 9-inch and 10- to 14-inch precipitation zones) and Central Rocky Mountains – 43B, (15- to 19-inch and 20+ inch precipitation zones) (USDA 2008). The following paragraphs described the land use, elevation and topography, climate, and water characteristics of these MLRAs.

Northern Intermountain Desertic Basins

Land use: More than half of this area is federal land; the remainder is a mixture of farms and ranches. Most of the land is used for livestock grazing. The range consists of desert shrubs and short grasses. About 5 percent of the area is irrigated. Most of the acreage is planted for alfalfa and other feed crops, but dry beans, malt barleys, sugar beets, and corn are also grown.

Elevation and topography: The elevation of the area ranges from 3,600 to 7,500 feet amsl. Piedmont plains and pediments slope from the mountains to the stream terraces of the Wind-Bighorn River system. In some places, the plains are eroded to the clay shale bedrock, and areas of badland.

Climate: Average annual precipitation in this area is 5 to 14 inches, with maximum precipitation in spring and fall. Average annual temperature is about 45°F and average freeze-free period is between 112 and 184 days per year.

Water: Low and erratic precipitation provides only a small amount of water to the area. The Wind-Bighorn River and its tributaries bring irrigation water into the area from the bordering mountains. Deep artesian wells provide water for irrigation on the eastern side of the Bighorn Basin.

Central Rocky Mountains

Land use: Almost all this area is federal land administered by the USFS, USDA, and the BLM. Forested areas are used as wildlife habitat, for recreation and watershed management, and for timber production. Meadows on the upper mountain slopes and crests above timberline provide summer grazing for livestock and big game animals. Less than 2 percent of the area is used for agriculture. Forage, grain, peas, and a few other crops are grown in some valleys.

Elevation and topography: The general elevation of the area ranges from 6,000 to 11,000 feet amsl. High mountains having steep slopes and sharp crests are cut by narrow valleys, most of which have steep gradients.

Climate: Average annual precipitation ranges from 15 to 20+ inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than years with more than normal precipitation. Temperatures vary widely between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Average annual temperature is 39°F. The average freeze-free period is 42 to 100 days.

Water: Moderate precipitation in the area and many perennial streams and lakes provide water. Streams and reservoirs supply water to adjoining MLRAs for irrigation and other uses. Springs and shallow wells in the valleys provide water for domestic use and for livestock. Elsewhere, groundwater supplies are small and mostly untapped (USDA 2008).

Table 3-25 summarizes the Wyoming Gap Analysis project of plant communities in the Planning Area. Map 36 shows these plant communities.

Table 3-25. Wyoming Gap Analysis Project Plant Communities within the Planning Area

Vegetation and Land Cover Type	BLM Surface (acres)	BLM Mineral Estate (acres)	Total (acres)[1]
Badlands/Rock Outcrop	71,333	75,693	86,079
Forest/Woodlands	298,390	470,123	603,046
Nonnative Annual Bromes	37,509	46,878	50,670
Open Water	684	2,934	16,119
Riparian/Wetlands	23,957	36,916	139,037
Grasslands and Sagebrush Shrublands	1,429,537	2,059,100	2,651,628
Salt Desert Shrub/Salt Bottom Shrub	1,297,954	1,406,645	1,568,051
Settlements/Agriculture	28,450	104,923	530,213

Source: USGS 2008c

[1]Total surface acres in the Planning Area, regardless of ownership.

BLM Bureau of Land Management

3.4.1 Vegetation – Forests, Woodlands, and Forest Products

Table 3-25 identifies forest and woodland acreages in the Planning Area. Approximately 9 percent of BLM-administered surface in the Planning Area is dominated by a combination forest and woodlands, which are comprised of juniper, limber pine, mixed conifer with aspen, and ponderosa pine.

The BLM is responsible for implementing management to achieve desired goals for forests and woodlands. The existing plans for the Planning Area are designed to restore and maintain forest health, and forest management activities are directed in accordance with sound silvicultural and multiple-use practices.

Forests in the Planning Area provide important habitat for flora and fauna, including several threatened or endangered species, such as Canada lynx, and species currently considered to be candidate or BLM-sensitive species. Forests also play an important role in the ecological processes and functions of ecosystems, such as energy flow, water, and nutrient cycling.

Forests and woodland communities in the Planning Area include aspen woodlands, Douglas-fir, juniper woodlands, lodgepole pine, limber pine, spruce-fir, whitebark pine, and ponderosa pine. Forestland is land capable of producing 20 cubic feet of wood fiber from commercial species per acre per year. Commercial forestland is land that has not been withdrawn from forest product harvest by law or statute. Woodlands are areas that are not capable of producing 20 cubic feet of wood fiber from commercial species per acre per year and have at least ten percent canopy cover. Woodlands range

from small uniform stands to larger mixed stands of aspen, limber pine, and Rocky Mountain juniper. Woodlands are ecologically important, especially as wildlife habitat.

The western slope of the Big Horn Mountains in the WFO includes substantial mixed-age stands of ponderosa pine. These stands are generally confined to dryer, poorer quality sites. Douglas-fir, Engelmann spruce, sub-alpine fir, and lodgepole pine grow on north-facing slopes in both the Big Horn and Absaroka Mountains. Forestlands also are found on Rattlesnake Mountain, the West Slope of the Big Horn Mountains, Carter Mountain, and on isolated public land parcels adjacent to Shoshone National Forest in the South and North Fork Shoshone River, and Wood River watersheds. Most forestland management occurs on Rattlesnake Mountain.

Forest and woodland areas in the Planning Area provide seasonal habitat for numerous songbirds, small mammals, predators, and big game, with concentrations of elk in winter (refer to Section 3.4.6 *Fish and Wildlife Resources – Wildlife* for additional information).

Stand productivity and vigor can be measured by the stand site index at a determined age, usually 100 years. Stand vigor is a general term that refers to the current growth and health of the stand; live crown ratio is a measure of stand vigor. For example, most stands with an average live crown ratio of 50 percent or more have vigorous growth; most stands with an average of less than 20 percent live crown ratio have poor vigor. Stand productivity can be measured by comparison to site index. If the site index is 75 feet at 100 years, but the stand averages 65 feet at 100 years, a factor such as high basal area or mistletoe might be decreasing stand productivity. Stocking can be measured by basal area for mature stands, and stems per acre for regeneration.

Indicators for forest and woodland health include endemic levels of native insects, disease, pathogens, and the levels of nonnative insects and disease. Numerous parts of the Planning Area have been affected by disease, insects, and pathogens. Bark beetle activity in the region generally increased from 2002 to 2011, with numerous incidences occurring across the Planning Area, but has since declined (USFS 2012). Approximately 320,015 acres of BLM-administered land in the Planning Area have been surveyed, with spruce beetle and mountain pine beetle identified as the primary damage causing agents (USFS 2014). A Douglas-fir bark beetle epidemic has affected several thousand forest acres on mixed ownership land in the Shell Canyon area; the spruce beetle has affected several thousand forest acres on mixed ownership land in the Carter Mountain area (BLM 2009a). Smaller outbreaks and infestations also are affecting conifers in the Absaroka and Big Horn Fronts, and on Rattlesnake Mountain. Most areas identified by the USFS as being at-risk for future back beetle infestations are located on the forested fringes of the Planning Area (USFS 2012).

Dwarf mistletoe, a parasitic seed plant commonly occurring in lodgepole pine, ponderosa pine, and Douglas-fir stands, can be found in forestlands throughout the Planning Area. Mistletoe causes growth loss, reduces vigor in trees, leaving them more susceptible to attack by insects, and can be difficult to treat due to inaccessible terrain in some parts of the Planning Area.

Prolonged drought in the Planning Area has weakened conifers and made them more susceptible to bark beetles, blister rust, and other stresses (BLM 2009a). Winters have been mild, exacerbating many of these biological stressors. Many of the mature conifer trees on public land have died or are dying. Many of the aspen woodlands, willow, and cottonwood forests found at mid to high elevations are declining as succession from deciduous to conifer (typically juniper/ponderosa pine) dominance proceeds. Conifer species are replacing cottonwood-dominated and some willow-dominated riparian areas. The loss of deciduous forestland vegetation is affecting watershed, riparian, and wetland function and stability and diversity of habitat. This loss is human influenced due to fire suppression and the introduction of nonnative invasive species. Throughout the interior west, aspen are declining

(Bartos 2001; Bartos and Campbell 1998; Rogers 2001). Older aspen stands are more susceptible to cankers, conks, and decays in the bole. Conifer succession is occurring in most aspen stands, which will likely result in further reductions in aspen presence. Barring any major surface disturbance (e.g., fire and mechanical treatment), conifers will eventually replace most of the aspen stands (Wyoming State Division of Forestry 2001).

Forest Communities

Douglas-fir

Douglas-fir stands vary in size from seedling-sapling stage to mature stands. Mixed and mature Douglas-fir stands vary in size from 1 to 20 inches in diameter at breast height (dbh), and from 1 to 120 feet in height. Trees with a dbh greater than 20 inches are an exception. Stand age ranges from 1 to 250 years. The Douglas-fir forest type ranges from healthy stands to those declining in vigor and productivity. Current age-class distribution is unbalanced toward mature stands, and there is a lack of late-successional Douglas-fir forests (BLM 2009b). Any future wildland fire disturbance in mature overstocked stands poses the risk of returning the entire forest type to an early-succession stage.

Spruce-fir

Spruce-fir stands vary in size from seedling-sapling stage to mature stands. Mixed and mature sub-alpine fir–Douglas-fir–Engelmann spruce stands vary in size from 1 to 20 inches in dbh, and from 1 to 140 feet in height. Trees with a dbh of more than 25 inches are an exception. Stand age ranges from 1 to 250 years. The spruce-fir forest type ranges from healthy stands to those declining in vigor and productivity. Current age-class distribution is unbalanced toward mature stands; there is a lack of late-successional spruce-fir forests (BLM 2009a). Any future wildland fire disturbance in mature overstocked stands poses the risk of returning the entire forest type to an early-succession stage.

Lodgepole Pine

Mixed and mature lodgepole stands vary in size from 1 to 20 inches in dbh. Trees with a dbh of more than 20 inches are an exception. Stand age ranges from 1 to 150 years. The lodgepole pine forest type ranges from healthy stands to those declining in vigor and productivity. Current age-class distribution is unbalanced toward mature stands, and there is a lack of late-successional lodgepole pine forests (BLM 2009a). Any future wildland fire disturbance in mature overstocked stands poses the risk of returning the entire forest type to an early-succession stage.

Woodland Communities

Limber Pine

Although not considered a commercial species, limber pine is an important food and cover source for birds and other wildlife. Blister rust has affected limber pine in the Planning Area. Blister rust can infect all five needle pines, of which limber pine is an example, and can kill both mature and sapling trees. Limber pine has experienced mortality throughout the Planning Area, especially in Ten Sleep Canyon and Grass Creek (BLM 2009a). There do appear to be some mature and sapling stage trees in these areas that are not infected, which might suggest some natural genetic resistance to the disease. These are apparently resistant trees in large infection zones.

Aspen Woodland

Aspen occupies a variety of sites ranging from steep, rocky slopes to lower, moister areas. Aspen reproduces rapidly after fire, regenerating primarily by suckering from underground rootstock. Fire control has led to a substantial drop in aspen regeneration and overall clone health. There are pure and mixed stands in and adjacent to the Big Horn and Absaroka Mountains, where conditions satisfy ecologic requirements for aspen. Aspen stands typically exhibit a diversity of understory vegetation, are used by wildlife and livestock, can serve as a natural fire break, and often occur as part of an important riparian/wetland component in the forest system. Due to past and present management practices, natural disturbances such as wildfire have not occurred in their historically cyclic way. As a result, most aspen stands in the Planning Area are remnant stands encroached upon by conifers (BLM 2009a). Aspen stands are generally overtaken by mixed conifer stands with a fire return interval of more than 100 years in this area. Most aspen stands have decreased in size and vigor over the past decades.

Juniper Woodland

Juniper woodlands are typically comprised of Utah juniper stands, sometimes mixed with Rocky Mountain juniper and limber pine, on steep slopes and ridge tops. After long periods without fire, juniper species encroach into and dominate sagebrush communities. The fire return interval in juniper woodlands depends on the terrain. In shallow, rocky soils, the fire return interval is more than 200 years (BLM 2009a). Juniper woodlands have increased in size over the past decades (BLM 2009a). Juniper invasion into rangeland sites in deeper soils is partly the result of a departure from the historic fire return interval. There are past studies and historic photos of Enos and Grass Creeks that quantify encroachment. Most juniper woodlands have vigorous growth and few insect pests or diseases limiting their growth.

Forest Products

Forest resources harvested in the Planning Area consist of small stands of ponderosa pine, Douglas-fir, lodgepole pine, aspen, and aspen/conifer mix. Wood products harvested in the Planning Area include saw timber, firewood, Christmas trees, posts and poles, and biomass used for fuel, paper, compost, and insulation. Juniper and limber pine species not traditionally used in commercial wood product markets dominate woodland areas.

Existing plans set forest management levels for the Planning Area. The annual allowable harvest level was set at 1,000 thousand board feet (mbf) for the WFO and 500 mbf for the CYFO (BLM 1988a; BLM 1990). The annual allowable harvest level is not specified for the Grass Creek planning area (BLM 1998a).

Most mature stands are on terrain inaccessible or too steep for equipment, not economically feasible to harvest, or are in areas administratively excluded from active forest management, such as WSAs or isolated tracts of BLM-administered land that have no legal access.

There is one commercial sawmill company presently operating near the Planning Area in Livingston, Montana. The sawmill in Cody, Wyoming, closed in 2006. There also are small, family operated businesses that engage in small, local sales for specialized products when available. There is a local market for firewood and post and poles.

Although there is regional demand for timber products from BLM-administered lands in the Planning Area, at present, forest productions from BLM-administered lands play a small role in the wood product industry. Engineered-wood product and biomass industries are currently insignificant in the region due

to lack of regional industry infrastructure, and the high costs of transporting products to distant manufacturing plants.

The combined sawlog volume for the Planning Area offered from 1993 through 2002 averaged 518 mbf per year. The sawlog volume offered from 2003 through 2009 increased to an average of 1,040 mbf per year (BLM 2009a; Neighbors 2010). The increase in volume offered was the result of aggressively treating and preventing the spread of bark beetles.

From 2003 through 2009, approximately 1,150 acres of noncommercial mechanical forest treatments were completed via combinations of service contracts, stewardship contracts, and seasonal fire and fuels crew labor (BLM 2009a; Neighbors 2010). These forest management treatments included precommercial thinning, ponderosa pine ladder fuels reduction, and aspen treatments. Many aspen treatments involve cutting conifers within aspen clones, lopping and scattering conifer slash to create a fuel bed, and prescribed burning. This is followed by monitoring the suckering response and constructing a temporary solar-powered electric fence if excessive browsing exceeds new growth.

Management Challenges

Management challenges for forests, woodlands, and forest products in the Planning Area include the lack of a natural fire interval and fuels management (see Section 3.3 *Fire and Fuels Management*); management of fragmented and isolated stands; encroachment of woodland species into other vegetation types; lack of a current forest inventory; declining or over-mature stands; and management of native and nonnative disease, insects, pathogens, and invasive species. The Healthy Forest Restoration Act of 2003 (102[e]) directs BLM field offices to identify management to protect old-growth trees and their equivalent associated with hazardous fuel reduction projects.

There are several insect and disease concerns that could compromise future forest health. Despite regional declines in bark beetle infestations, infestations could continue in areas where susceptible host trees remain, requiring further management. Often, infestations occur on isolated tracts that are inaccessible and are not documented unless they show up on aerial flights or adjacent landowners inform the BLM of the problem.

The wood product industry has diversified, and forest products from public lands could be used to fill niches such as chips, shavings for animal bedding, house logs, biomass for rehabilitating disturbed areas, bulk for landscaping, compost, possibly alternative fuels such as pellets, and the traditional logs, firewood, posts and poles. These industries are not present in the local area, but could enter the area in the future. The mill in Saratoga could resume operations in the future. However, the cost required for road construction, traditionally appraised in the stumpage value of the sale, could result in administrative costs more than proceeds from the forest.

Climate change could be playing a role in recently observed changes in forest health. Forest communities are resilient in responding to normal variations in weather and climate to which they are adapted. However, increases in forest insect infestations and tree mortality throughout the Planning Area might be partly due to climatic factors such as warmer and drier summer conditions and warmer winters, acting in combination with other variables such as long-term fire suppression, particularly in areas where stands are overstocked.

3.4.2 Vegetation – Grassland and Shrubland Communities

Approximately 86 percent of BLM-administered surface in the Planning Area is characterized as sagebrush shrublands and salt desert shrub/salt bottom shrub. Sagebrush shrublands in the Planning Area contain grassland components that are generally not large or contiguous enough to form distinct grassland communities at the landscape level; however, these grassland components increase habitat heterogeneity within localized areas.

Livestock grazing, fire, fire suppression, and to a lesser extent surface-disturbing activities, have influenced many grassland/shrub vegetative types in the Planning Area. Invasive species have encroached into many plant communities. Refer to Section 3.6.7 *Livestock Grazing Management*, Section 3.3 *Fire and Fuels Management*, and Section 3.4.4 *Invasive Species and Pest Management* for additional information.

The broad scale Wyoming GAP analysis data are used in this analysis, as this data is appropriate for regional and large area planning efforts. Actual on-the-ground management is conducted using ecological site descriptions developed by the Natural Resources Conservation Service (NRCS), of which there are more than 60 for the Planning Area.

Grasslands

Grassland components in the Planning Area are generally located in valley bottoms, uppermost south-facing slopes, and scattered patches on windswept ridges. Grasslands are split into four plant communities – mixed grass prairie, Great Basin foothills grassland, meadow tundra, and subalpine meadow – as described below. As stated above, on-the-ground habitat conditions suggest that grasslands are not present as distinct vegetation communities in the Planning Area, but do occur as components within shrubland communities that influence overall habitat character.

Mixed Grass Prairie

Mixed grass prairie contains a mixture of short grass and tall grass prairie species. Vegetation can contain or be dominated by silver sagebrush; trees and shrubs cannot occupy more than 25 percent of the total cover. Mixed grass prairie provides habitat for sensitive species such as the mountain plover, Baird's sparrow, long-billed curlew, black-footed ferret, white-tailed prairie dog, and various bat species. Typical ecological sites found in the mixed grass prairie plant community include Overland Flow 10- to 14-inch precipitation zone and Overland Flow 15- to 19-inch precipitation zone.

Great Basin Foothills Grassland

Great Basin foothills grassland is a mesic grass-forb mixture found in the foothills of northwestern Wyoming. There may be an important lupine or arrowleaf balsamroot component found in this type of grassland. This community provides habitat for sensitive species such as the mountain plover, Baird's sparrow, long-billed curlew, black-footed ferret, white-tailed prairie dog, and various bat species. Typical ecological sites found in the Great Basin foothill grassland plant community include Loamy 15- to 19-inch precipitation zone and Shallow Loamy 15- to 19-inch precipitation zone.

Meadow Tundra

Meadow tundra includes graminoid- and forb-dominated vegetation that occurs above the upper tree line (approximately 9,800 feet amsl) in the alpine zone. Common species in this vegetation type include bent grasses, sheep fescue, icegrass, and alpine mosses. This community provides habitat for sensitive species such as the greater sage-grouse and various species of migratory birds. Typical ecological sites in

the meadow tundra plant community include Course Upland 15- to 19-inch precipitation zone and Very Shallow 20+-inch precipitation zone.

Subalpine Meadow

Subalpine meadow occurs between an elevation of about 4,700 feet and 9,800 feet amsl. It is characterized and dominated by graminoids and forbs. Typical ecological sites in the subalpine meadow tundra plant community include Wetland 10- to 14-inch precipitation zone and Wetland 15- to 19-inch precipitation zone. This community provides habitat for sensitive species such as the greater sage-grouse and various species of migratory birds.

Shrublands

Shrublands dominate the Planning Area, representing approximately 2,727,491 acres of BLM-administered land and 3,465,745 acres of federal mineral estate (86 percent of all BLM-administered surface land or 83 percent of all federal mineral estate). These communities are generally diverse in plant composition and provide important forage and cover for wildlife and livestock. Shrublands are split into seven plant communities – mesic upland shrub, xeric upland shrub, mountain big sagebrush, Wyoming big sagebrush, desert shrub, saltbush fans and flats, and greasewood fans and flats – as described below.

Mesic Upland Shrub

This vegetation type includes a variety of shrub communities that grow in relatively mesic sites (often snow catchments or in ravines). Most often, Rocky Mountain maple, bigtooth maples, snowberry, wax currant, or chokecherry are the dominant shrub species. Typical ecological sites in the mesic upland shrub plant community include Course Upland 20+-inch precipitation zone.

Xeric Upland Shrub

Xeric upland shrub is a shrub cover dominated by species of curlleaf mountain mahogany. This community provides habitat for many species, including various bat, raptor, and mammal species. Typical ecological sites in the xeric upland shrub plant community include Steep Loamy 20+-inch precipitation zone.

Mountain Big Sagebrush

This shrub type is dominated by mountain big sagebrush often found mixed with grasses. This community provides habitat for sensitive species, including the greater sage-grouse and other sagebrush obligate species. Typical ecological sites in the mountain big sagebrush plant community include Loamy 10- to 14-inch precipitation zone, Shallow Loamy 10- to 14-inch precipitation zone, Sandy 10- to 14-inch precipitation zone, Shallow Sandy 10- to 14-inch precipitation zone, Clayey 10- to 14-inch precipitation zone, and Shallow Clayey 10- to 14-inch precipitation zone.

Wyoming Big Sagebrush

This vegetation type is a shrub steppe type dominated by Wyoming big sagebrush. This vegetation type can vary from dense, homogeneous Wyoming big sagebrush to sparsely vegetated arid areas where Wyoming big sagebrush is the dominant shrub. This community provides habitat for sensitive species, including the Brewer's sparrow, loggerhead shrike, sage thrasher, ferruginous hawk, and the greater sage-grouse. Typical ecological sites in the Wyoming big sagebrush plant community include Loamy 5- to 9-inch precipitation zone, Shallow Loamy 5- to 9-inch precipitation zone, Sandy 5- to 9-inch

precipitation zone, Shallow Sandy 5- to 9-inch precipitation zone, Clayey 5- to 9-inch precipitation zone, and Gravelly 5- to 9-inch precipitation zone.

Desert Shrub

This vegetation type consists of a mixture of shrubs occurring in dry, saline habitats. Shrubs in this vegetation type are often dominated by shadscale saltbush, but can also be a mixture of Gardner's saltbush, black greasewood, and desert cushion plants. This community provides habitat for sensitive species, including the greater sage-grouse, Brewer's sparrow, loggerhead shrike, sage thrasher, and ferruginous hawk. Typical ecological sites in the desert shrub plant community include Saline Upland 5- to 9-inch precipitation zone, Saline Upland 10- to 14-inch precipitation zone, Shale 5- to 9-inch precipitation zone, and Shale 10- to 14-inch precipitation zone.

Saltbush Fans and Flats

This vegetation type consists of areas where Gardner's saltbush comprise more than 75 percent of the vegetative cover. These relatively pure saltbush stands are often sparsely vegetated, with bare soil constituting most of the land surface. This community provides habitat for sensitive species, including mountain plover, greater sage-grouse, long-billed curlew, ferruginous hawk, loggerhead shrike, Brewer's sparrow, and burrowing owl. Typical ecological sites in the saltbush fans and flats community include Saline Upland 5- to 9-inch precipitation zone and Saline Upland 10- to 14-inch precipitation zone.

Greasewood Fans and Flats

This vegetation type consists of areas where greasewood comprises more than 75 percent of the total shrub cover and shrubs comprise more than 25 percent of the total vegetative cover. This community provides habitat for sensitive species, including Brewer's sparrow, loggerhead shrike, sage thrasher, and ferruginous hawk. Typical ecological sites in the greasewood fans and flats plant community include Saline Lowland 5- to 9-inch precipitation zone and Saline Lowland 10- to 14-inch precipitation zone.

Resource Condition

Common indicators of rangeland health include organic ground cover (live and dead), plant species composition and diversity, bare ground, litter, and the presence and density of noxious weed species. These indicators are associated with Standards 1, 3, and 4 of the *Wyoming Standards for Healthy Rangelands* (Appendix N).

The presence of noxious weeds and other invasive species might indicate a disturbance to the native plant community. Denser populations of invasive species are generally associated with areas that have been affected by surface-disturbing activities, wildfire, changes in water regime, or other major events. The presence and accelerating rate of spread of undesirable plants is a threat that could reduce the ability of vegetation to continue providing desired levels of products and services.

Indicators of rangeland health described in *Technical Reference 1734-6, Interpreting Indicators of Rangeland Health* include soil surface resistance to erosion and soil loss or degradation (including soil compaction); plant community composition and distribution in relation to infiltration and runoff; functional/structural groups; ratio of plant mortality/decadence to young or mature individuals in the community; amount of litter; annual production; invasive plants; and reproductive capability of perennial plants (BLM 2005c).

Fire suppression, historic livestock grazing practices, and road development have disrupted fire return intervals in the sagebrush/grassland plant communities. As a result, there has been an increase in juniper density with a corresponding decrease in perennial bunch grasses and forbs, and in some areas a

loss of age class and structural diversity. In recent years, invasive species, particularly nonnative bromes, have increased greatly in the Planning Area. Many areas in the sagebrush/grassland community that have experienced multiple wildfires have been converted to cheatgrass monocultures.

Since the completion of the Cody, Grass Creek, and Washakie RMPs, approximately 423 projects and 82,314 acres of vegetation treatments have been initiated in the Planning Area (see Section 3.6.7 *Livestock Grazing Management*) to address changes in vegetative condition (BLM 2009a). Vegetation treatments are currently implemented under the principles and methodology in Instruction Memorandum (IM) 2008-030 (BLM 2007c), which gives guidance to BLM field offices on implementing the Record of Decision (ROD) for the National Vegetation Treatments Final Programmatic EIS (BLM 2007b) and Programmatic Environmental Report.

Grassland and shrubland vegetative communities are subject to the influences of wildfire and prescribed fire. See Section 3.3 *Fire and Fuels Management* for more discussion on FRCC as it relates to vegetation.

In the Planning Area, the BLM is implementing the Wyoming Reclamation Policy (BLM 2012b), which identifies ten reclamation requirements, of which restoring a disturbed site to sound ecological health and controlling invasive species are priorities.

Management Challenges

Invasive plant species can dramatically affect native plant communities and disrupt the functions of native ecosystems. Nonnative bromes continue to expand their range throughout the Planning Area. If they are allowed to proliferate, invasive plant species and noxious weeds have the potential to negate any existing or future improvement in vegetation resources. If future circumstances result in a net loss of productive vegetation, the present supply of vegetation and kinds of goods and services vegetation provides society will not be sustainable (refer to Section 3.4.4 *Invasive Species and Pest Management*).

The loss of soil through wind and water erosion can remove valuable nutrients and organic matter from the ecosystem. When the rate of loss exceeds the rate of soil formation there is a net loss of soil. There is a threshold when the amount of soil loss starts to affect plant communities. This threshold varies with soil type. Once a threshold has been crossed, the plant community that could be supported on a site could change. See Section 3.1.3 *Soil* for more information.

3.4.3 Vegetation – Riparian/Wetland Resources

Riparian ecosystems occupy the transition between upland and water ecosystems and include flood plains, stream banks, lake shores, and wetlands. They are some of the most productive resources found on public or private lands. They comprise less than 2 percent of the western landscape, yet are prized by communities for their recreational, fish and wildlife, water supply, cultural, and historic values, and for their economic values, which stem from use in livestock production and forest management (Cooperative Riparian Restoration Montana 2006).

Riparian/wetland sites in the Planning Area are described as lentic or lotic. Lentic refers to standing water such as in lakes, springs, and bogs. Lotic refers to flowing water such as rivers and streams.

Documented riparian/wetland areas in the Planning Area range from cottonwood galleries along major rivers, to wet meadows and seeps and narrow ribbons of willow/water birch, sedge, rush, and/or grass that run along small streams. Some of the surface water features that support riparian/wetland areas can be dry for long periods and experience wide variations in the frequency and magnitude of flood events. Native cottonwood galleries along riparian corridors provide habitat for migratory birds and

owls and for white-tailed and mule deer. Many terrestrial wildlife species use more than one riparian habitat type, although some use only one or two.

Riparian/wetland areas in the Planning Area perform important ecological processes and functions such as water, energy, and nutrient cycling. Healthy riparian/wetland areas support stable banks and shorelines; flood plain maintenance; clean and stable water supplies; aquifer recharge; flood-energy dissipation and moderation; fish and wildlife habitat; livestock and wildlife forage; opportunities for recreation; carbon sequestration; and scenic values.

Riparian/Wetland Communities

Riparian/wetland communities in the Planning Area include forest-dominated riparian areas, shrub-dominated riparian areas, and graminoid/forb-dominated wetlands, as described below.

Forest-dominated Riparian Areas

Forest-dominated riparian areas are dominated by tree species. In the Planning Area, these are usually cottonwood species, but also can be aspen, boxelder, a variety of conifer species, and Russian olive (an introduced nonnative species considered to be a noxious weed). Trees must occupy more than 25 percent of the vegetative cover within a riparian zone to be classified as forest-dominated riparian. Diagnostic plant species include eastern cottonwood, narrowleaf cottonwood, quaking aspen, boxelder, and conifer species.

Shrub-dominated Riparian Areas

These riparian areas are characterized by areas where shrubs comprise more than 25 percent of the vegetative cover and where trees occupy less than 25 percent of the total vegetative cover. Shrubs often include willow species, sagebrush species, and greasewood. Other shrubs, including hawthorn, wild plum, birch, alder, shrubby cinquefoil, and Tamarisk (an introduced nonnative species considered to be a noxious weed) might also be present. Alpine riparian zones are generally dominated by willows or other shrubs.

Graminoid-/Forb-dominated Wetland Areas

These areas are characterized by grasses or forbs; trees or shrubs cannot occupy more than 25 percent of the total vegetative cover. This wetland type includes communities such as wet and moist meadow grasslands, marsh and swamp wetlands, cattail, bulrush- and sedge-dominated wetlands, and inland saltgrass/alkali sacaton-dominated wetlands, including both low- and high-salinity wetlands. Low-salinity wetlands are characterized by cattails, Baltic rush, sedges and rushes, and prairie cordgrass. High-salinity wetlands are characterized by alkali sacaton, alkali cordgrass, saltgrass, sea blight, and riparian wheatgrass.

Riparian/Wetland Inventory

Riparian/wetland areas in the Planning Area are inventoried to estimate their functional status using PFC assessment methodologies developed by the BLM, USFS, NRCS, and others (BLM 1998b; BLM 1999). These methodologies employ an interdisciplinary team that inspects and analyzes the attributes and processes associated with a riparian/wetland area's hydrology, vegetation, and soils to estimate its relative health. In the Planning Area, inventoried riparian/wetland areas include approximately 1,617 acres of lentic and 1,205 miles of lotic riparian/wetlands (BLM 2009j). Table 3-26 provides the results of the riparian/wetland PFC inventories for the Planning Area.

Table 3-26. Wetland Inventory Data

Functional Status	Wetlands (lentic features) (acres)	Riparian (lotic features) (miles)
Proper Functioning Condition	136	417
Functioning-at-Risk Upward Trend	155	225
Functioning-at-Risk Downward Trend	355	213
Functioning-at-Risk No apparent Trend	963	182
Non-Functioning	8	99
Unknown	0	69
Total	**1,617**	**1,205**

Sources: USFWS 2008; BLM 2009j.

PFC assessments seem to indicate that many riparian/wetland areas in the Planning Area have improved over the last 15 to 20 years in response to implemented changes in grazing and other management actions. During this time, livestock grazing schedules have been modified to reduce or eliminate growing and/or hot-season use and increase dormant and cool-season use and/or rest periods to provide plants with recovery time.

Vegetation in riparian areas is the first of the functional components to respond to changes in management. The establishment of species, such as sedges and rushes that capture sediment and stabilize stream banks, indicates an upward trend in functional status. The physical attributes of the streams (sinuosity and width to depth ratio, erosion and deposition, lateral and vertical stability) respond slower than vegetation, because their development and stability depends on healthy, vigorous riparian/wetland vegetation.

There are a number of indicators used to evaluate the condition of riparian/wetland areas, as described below.

Obligate Plant Species and Facultative Wetland Plant Species – Obligate plant species (plants that occur more than 99 percent of the time in wetlands) and Facultative Wetland plant species (plants that occur 67 to 99 percent of the time in wetlands) are used as riparian indicator plants. Some of the more common indicator plants in the Planning Area include, but are not limited to, Baltic rush, Nebraska sedge, common threesquare, willows, cottonwood, cattails, spikerush, and alkali bulrush.

Proper Functioning Condition – PFC is a riparian health assessment and communication tool that focuses on the attributes and processes associated with a riparian/wetland area's hydrology, vegetation, and soils instead of its values or uses. Indicators considered when assessing the functional state of lotic riparian/wetland areas include:

- Hydrologic Indicators
  - Flood plain above bankfull is inundated in "relatively frequent" events.
  - Where beaver dams are present, they are active and stable.
  - Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (landform, geology, and bioclimate region).
  - Riparian/wetland area is widening or has achieved potential extent.
  - Upland watershed is not contributing to riparian/wetland degradation.

- Vegetation Indicators
  - There is diverse age-class distribution of riparian/wetland vegetation (recruitment for maintenance/recovery).
  - There is a diverse composition of riparian/wetland vegetation (for maintenance/recovery).
  - Plant species present indicate maintenance of riparian/wetland soil moisture characteristics.
  - Stream bank vegetation is comprised of plants or plant communities with root masses capable of withstanding high streamflow events.
  - Riparian/wetland plants exhibit high vigor.
  - Adequate riparian/wetland vegetation is present to protect banks and dissipate energy during high flows.
  - Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery).
  - Erosion/Deposition (Soil) Indicators.
  - Flood plain and channel characteristics (rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy.
  - Point bars are revegetating with riparian/wetland vegetation.
  - Lateral stream movement is associated with natural sinuosity.
  - The system is vertically stable.
  - The stream is in balance, with the water and sediment being supplied by the watershed (no excessive erosion or deposition).

Indicators considered when assessing lentic riparian/wetland areas are similar to those used for flowing riparian/wetland areas, but they have been modified to address wave, wind, and/or overland flow energies instead of the high water flow energies experienced by flowing water systems.

Invasive Species – Invasive plant species displace native riparian/wetland plant species and can disrupt or degrade riparian/wetland areas to the point that they no longer function properly or provide habitat for riparian-dependent native flora and fauna. In the Planning Area, riparian invasive species include nonnative bromes, Russian olive, Tamarisk, and Russian knapweed.

Management Challenges

Although 2009 was an above-average precipitation year, precipitation has been below normal in 6 of the 9 years since 2000. Small streams and portions of larger streams have experienced minimal or no flows. The reduced amount of available water has resulted in lower flows in unregulated streams, and lower outflows from reservoirs in and around the Bighorn Basin. Reduced amounts of water due to drought have had an adverse impact on riparian/wetland habitat improvement. In general, the most common adverse impacts include a slowing in the rate of improvement in those areas where appropriate management has been implemented and an increase in the rate of decline where appropriate management has not yet been implemented. This has had a greater impact on fisheries than on riparian conditions. Thus, riparian conditions continue to improve while some fisheries appear to be declining (BLM 2009a).

Sixty-seven of the 252 livestock grazing allotments that have been evaluated for conformance with the *Wyoming Standards for Healthy Rangelands* failed riparian/wetland area standard #2 (Appendix N). Standard #2 states that "riparian and wetland vegetation has structural, age and species diversity characteristic of the stage of channel succession and is resilient and capable of recovering from natural

and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for groundwater recharge." Allotments can fail standard #2 for many reasons. If failure to meet the standard is attributable to existing livestock grazing management or utilization level, then the BLM must make management changes to correct the issue. If failure to meet the standard is attributable to other factors (e.g., encroaching juniper, recent wildfire, discontinued historic grazing patterns, or the presence of noxious weeds), then the BLM is not required to make changes to livestock grazing.

Proactive management practices such as prescribed fire, brush mowing/beating, successful reclamation of surface disturbance, applying BMPs and standard surface-disturbing guidelines, travel management, and implementing riparian/wetland compatible livestock grazing management can have a beneficial influence on associated riparian/wetland areas and their watersheds.

3.4.4 Invasive Species and Pest Management

Invasive and noxious plant species are common impediments to management objectives in the Planning Area. Invasive species are, for the most part, nonnative species whose introduction into an environment where they did not evolve causes, or is likely to cause, economic or ecological harm. These species make efficient use of local natural resources difficult and often interfere with achieving management objectives for the site. Noxious species are species designated by federal, state (State of Wyoming Noxious Weed List), or county government (Weed Control Districts) as injurious to public health (Tables 3-27 and 3-28). Although noxious weeds are almost always nonnative, this RMP and EIS makes a distinction because noxious weeds can include undesirable native plants. A pest can be any biological life form that poses a threat to human or ecological health and welfare.

Table 3-27. Wyoming Weed and Pest Control Act Designated List

Common Name	Common Name	Common Name	Common Name
Canada thistle	Field bindweed	Perennial sowthistle	Skeletonleaf bursage
Common burdock	Hoary cress (whitetop)	Plumeless thistle	Spotted knapweed
Common St. Johnswort	Houndstongue	Purple loosestrife	Tamarisk saltcedar
Common tansy	Leafy spurge	Quackgrass	Yellow toadflax
Diffuse knapweed	Musk thistle	Russian knapweed	-
Dalmatian toadflax	Oxeye daisy	Russian olive	-
Dyers woad	Perennial pepperweed (giant whitetop)	Scotch thistle	-

Source: Wyoming Weed and Pest Council 2012a

Table 3-28. Declared List of Weeds and Pests by Planning Area County, 2008

Common Name	Common Name	Common Name	Common Name
Big Horn County			
Baby's breath	Italian thistle	Redstem filaree	Tansy ragwort
Black henbane	Japanese knotweed	Rush skeletonweed	Teasel
Common crupina	Meadow knapweed	Scentless chamomile	Venice mallow
Distaff thistle	Medusahead	Scotch broom	Viper's bugloss
Field dodder	Orange hawkweed	Squarrose knapweed	Yellow hawkweed
Goatsrue	Poison hemlock	Swainsonpea	Yellow starthistle
Gorse	Puncturevine	Sulfur cinquefoil	-
Iberian starthistle	Purple starthistle	Syrian beancaper	-
Hot Springs County			
Puncturevine	Wild oats	-	-
Park County			
Black henbane	Chicory	Flixweed	Showy milkweed
Blue mustard	Common mullein	Lanceleaf sage	Wild four o'clock
Bull thistle	Dames rocket	Redstem filaree	-
Washakie County			
Absinth wormwood	Meadow knapweed	Scentless chamomile	Teasel
Black henbane	Medusahead	Scotch broom	Venice mallow
Common crupina	Orange hawkweed	Squarrose knapweed	Wild licorice
Common mullein	Puncturevine	Sulfur cinquefoil	Yellow hawkweed
Distaff thistle	Purple starthistle	Swainsonpea	Yellow starthistle
Iberian starthistle	Rush skeletonweed	Tansy ragwort	-
Italian thistle	Sandbur	Tall mountain larkspur	-

Source: Wyoming Weed and Pest Council 2012b

The CYFO and WFO control invasive species on BLM-administered lands through cooperative agreements with the Big Horn County, Hot Springs County, Park County, and Washakie County Weed and Pest Control Districts. In addition to the county weed and pest control districts, both field offices work in cooperation with the Wyoming Game and Fish Department (WGFD), State Lands Division, State Parks, local NRCS offices, and private landowners. Invasive species are an increasing problem in the Planning Area and are affecting water and other resources.

In 2004, there was an invasive species inventory of 40 percent of the Bighorn Basin. Based on the results of this inventory, it was estimated that there were approximately 60,000 acres infested with invasive species (BLM 2008a). There are an ever-expanding number of acres infested, especially with Russian knapweed, leafy spurge, perennial pepperweed, Russian olive, and Tamarisk along the Bighorn River and its tributaries. Additional new weed species such as cheatgrass are beginning to appear in other locations in the Bighorn Basin.

There has been an increase in weed occurrences in developed oil and gas fields, along roads and pipelines, and on public lands with increasing recreational use. The shrub component of the plant community often takes decades or more to establish, and even longer to reestablish after disturbance. Many reclamation efforts performed 20 or more years ago still do not have shrubs established and have not achieved reestablishment of wildlife habitat comparable to that before disturbances.

Two invasive species of special concern are Russian olive and Tamarisk, which deplete water and are replacing cottonwood and willow. Work has begun on controlling the two species; however, observations indicate that these invasive species are spreading within the boundaries of the Planning Area (BLM 2009a).

In 2009, the WFO estimated that approximately 57,000 acres in the field office were infested with nonnative annual bromes (primarily cheatgrass and Japanese brome) (BLM 2009a). These bromes appear to be invading grassland, sagebrush grassland, mixed grass prairie, desert shrub, and mountain shrub community types. Inventory information is available for only about 10 percent of the Bighorn Basin, so actual infested acreage might vary.

Both the CYFO and WFO are targeting plants that are designated on the State of Wyoming Noxious Weed List or declared on the county noxious weed lists (refer to Tables 3-27 and 3-28). The primary species targeted on public lands include cheatgrass, Russian knapweed, spotted knapweed, diffuse knapweed, leafy spurge, Dalmatian toadflax, Canada thistle, scotch thistle, musk thistle, houndstongue, hoary cress (whitetop), field bindweed, puncture vine, Russian olive, and Tamarisk. These plants are typically found in sagebrush/grassland, desert shrub, and riparian/wetland community types. The present goal is to contain and reduce densities of invasive species populations. Table 3-29 lists the number of acres of each species the BLM treats in the Planning Area.

The CYFO and WFO treat approximately 2,500 acres of invasive-species-infested areas annually. The BLM endeavors to acquire more inventory and monitoring data, but there still is not enough available data to determine the actual trends in invasive species establishment. Based on observations and reports from Weed and Pest Control Districts, treatment efforts appear to be keeping invasive plant species populations from continued rapid spread, but are not necessarily reducing existing populations.

Cooperative Management in Invasive Species and Pest Control

The BLM manages noxious and invasive weeds in the Planning Area pursuant to BLM goals described in *Partners Against Weeds, An Action Plan for the Bureau of Land Management* (BLM 1996). These goals include prevention and detection; education and awareness; inventory; planning; integrated weed management; coordination; and monitoring, evaluation, research and technology transfer.

Table 3-29. Treatment of Invasive Plant Species in the Planning Area

Species Treated	Acres of Treatment per year	Species Treated	Acres of Treatment per year
Absinth wormwood	0.20	Musk thistle	37
Black henbane	1.20	Oxeye daisy	1.80
Bull thistle	3.30	Perennial pepperweed	16.50
Canada thistle	630	Perennial sowthistle	1.80
Cheatgrass	1,000	Puncturevine	1
Common burdock	2.50	Purple loosestrife	3.80
Common mullein	1.18	Russian olive	76
Common tansy	0.62	Russian knapweed	535
Dalmatian toadflax	32.50	Scotch thistle	0.34
Diffuse knapweed	0.20	Spotted knapweed	25
Field bindweed	365	Sulphur cinquefoil	0.10
Houndstongue	27.50	Swainsonpea	3
Japanese knotweed	0.01	Tamarisk	50
Leafy spurge	10	Whitetop	300

Source: BLM 2007b

The BLM adheres to the concept of integrated pest management, or the use of a wide range of available tools and techniques to meet management objectives in site-specific situations. Vegetation treatments, including those for noxious weeds on public lands, are currently implemented under the principles and methodology outlined in IM No. 2008-030 (BLM 2007c), and instruction for implementing the ROD for the National Vegetation Treatments Final Programmatic EIS (BLM 2007b). In addition, IM WY-2012-032, Wyoming BLM Reclamation Policy (BLM 2012b), identifies 10 reclamation requirements, of which managing invasive plants is one, which must be addressed when developing reclamation proposals for all surface-disturbing activities.

The BLM manages invasive species in the Planning Area in nine weed management areas and two Coordinated Resource Management areas for weeds. Most of the species the BLM targets for management have not invaded BLM-administered lands in the Planning Area; however, invasive species that have invaded BLM-administered lands are expanding their range (BLM 2009a). The goal is to contain and reduce densities of known invasive species populations, though only limited portions of the Planning Area have been inventoried for invasive species.

Pest Management

In February 2003, the USDA Animal and Plant Health Inspection Service (APHIS) and the BLM signed an MOU detailing cooperative efforts to suppress grasshoppers and Mormon crickets on BLM-administered lands (APHIS AND BLM 2003). This MOU clarifies that APHIS will prepare and issue to the public site-specific environmental documents that evaluate potential impacts associated with proposed measures to suppress economically damaging grasshopper and Mormon cricket populations. The BLM must also

approve a Pesticide Use Proposal (Form FS-2100-2) for APHIS to treat infestations. APHIS would begin treatments after environmental review and BLM approval of the Pesticide Use Proposal.

Wyoming-designated pests under Wyoming Statute 11-5-102(a) (xii) include grasshoppers, Mormon crickets, prairie dogs, ground squirrels, mountain bark beetle, and beet leafhopper. The preferred method for treating grasshoppers and Mormon crickets is by Reduced Agent Area Treatments (RAAT). RAATs are a grasshopper suppression method in which the rate of insecticide is reduced from conventional levels, and treated swaths are alternated with swaths that are not directly treated. The RAAT strategy relies on the effects of an insecticide to suppress grasshoppers within treated areas while conserving grasshopper predators and parasites in areas not directly treated.

Fish and Wildlife Resources

The BLM is responsible for managing fisheries and wildlife habitats, and state and federal wildlife management agencies oversee BLM management activities. Fisheries habitat includes perennial and intermittent streams, lakes, and reservoirs that support fish through at least a portion of the year. See Section 3.1.4 *Water* for a description of drainages in the Planning Area that provide fisheries habitat, including the Bighorn River, Wind River, Clarks Fork of the Yellowstone River, and their associated tributaries, including the Nowood, Greybull and Shoshone rivers systems (Map 3). Aquatic habitat varies by vegetation type, water quality and quantity, land use, and landscape setting within these drainages and their tributaries. The U.S. Fish and Wildlife Service (USFWS) provides regulatory oversight for all species listed, proposed for listing, or candidates for listing under the ESA (see the *Special Status Species* section in this chapter). The USFWS also administers the Migratory Bird Treaty Act, which protects migratory bird species whether they are hunted (as with waterfowl) or not (as with songbirds).

3.4.5 Fish and Wildlife Resources – Fish

The BLM manages fish habitats according to laws, regulations, BLM policies, and principles of fisheries management within the BLM multiple-use mandate. State and federal game management agencies oversee aquatic species, to the extent they are directly managed. The WGFD is responsible for regulating the sport and commercial take of all fish in the Planning Area. The USFWS has oversight over federally threatened or endangered species. There are no federally listed fish species in the Bighorn Basin (refer to Section 3.4.8 *Special Status Species – Fish* for more detailed information). However, the BLM directly manages habitat that supports game and nongame fish species where there is such habitat on BLM-administered lands, and BLM management indirectly affects all aquatic species upstream and downstream of BLM-administered lands. The BLM manages wildlife habitat in the Planning Area according to a number of habitat management plans (HMP) (refer to Section 3.4.6 *Fish and Wildlife Resources – Wildlife*). Although there are no specific HMPs for fish species, actions in existing HMPs that improve riparian habitat often improve habitat for fish species.

Within the Planning Area, BLM-administered lands contain fisheries resources that include cold-water streams draining the Big Horn Mountains to the east and the Absaroka Range to the west; the tail-water trout fishery at Thermopolis; the cool-water fishery of the lower Bighorn, Shoshone, Greybull, and Nowood rivers; and the warm-water fisheries of several small lakes or ponds. There are no natural lakes or ponds in the Bighorn Basin that support fisheries.

Fisheries in the Bighorn Basin occur in the Bighorn River and Clarks Fork of the Yellowstone watersheds and include several major perennial tributaries – Owl Creek, Cottonwood Creek, Grass Creek, Gooseberry Creek, Greybull River, Wood River, Shoshone River, Kirby Creek, Nowater Creek, Nowood River, Shell Creek, Porcupine Creek, and Dry Creek. Most fish populations occur in the larger rivers and their tributaries, although there are several WGFD-stocked reservoirs and ponds.

Fish are typically classified as game or nongame; cold, cool, or warm water, and as native or nonnative. Species are adapted to a variety of stream habitats, from cold, rapid waters in higher elevations to slow, turbid waters of the high desert. According to the WGFD database, of the approximately 1,170 miles of streams on BLM-administered public lands in the Planning Area, approximately 395 miles support fisheries. The rest of the streams have no fish present or populations too low to adequately sample.

Fishing is an important component to the Bighorn Basin culture. The WGFD manages most cold-water streams for brook, brown, cutthroat, and rainbow trout. In addition, management on some streams is focused on mountain whitefish, and Yellowstone cutthroat trout. Many lower-elevation waters in the

Planning Area are managed for cool- and warm-water native game fish, such as sauger and channel catfish, along with the native nongame species, such as numerous minnow and sucker species that provide forage for sport-fish species. There are four nongame species on WGFD list of Species of Greatest Conservation Need in the Planning Area – sturgeon chub, mountain sucker, and plains and western silvery minnow. Habitat for these species is being diminished by anthropogenic factors such as alteration to stream channel morphology, and changes due to dam construction and increased sedimentation in the Shoshone and lower Bighorn River systems. There are approximately 40 fish species in the Planning Area (Table 3-30).

Table 3-30. Fish Species in the Planning Area

Common Name	Native to Wyoming	Native to the Planning Area	Game/ Nongame	Habitat
Black bullhead	Yes	No	Game	Warm/Lentic
Black crappie	No	No	Game	Warm/Lentic
Bonneville cutthroat trout	Yes	No	Game	Cold/Lentic and Lotic
Brook stickleback	No	No	Nongame	Cool-Warm
Brook trout	No	No	Game	Cold/Lentic and Lotic
Brown trout	No	No	Game	Cold/Lentic and Lotic
Burbot	Yes	Bighorn Drainage	Game	Cool-Warm/Lentic and Lotic
Carp	No	No	Nongame	Cool-Warm
Channel catfish	Yes	Bighorn Drainage	Game	Cool-Warm/Lentic and Lotic
Emerald shiner	No	No	Nongame	Cool-Warm
Fathead minnow	Yes	Bighorn Drainage	Nongame	Cool-Warm
Flathead chub	Yes	Bighorn Drainage	Nongame	Cool-Warm
Golden shiner	No	No	Nongame	Cool-Warm
Grayling	Yes	No	Game	Cold/Lentic and Lotic
Green sunfish	No	No	Game	Warm/Lentic
Lake chub	Yes	Bighorn Drainage	Nongame	Cool-Warm
Lake trout	No	No	Game	Cold/Lentic and Lotic
Largemouth bass	No	No	Game	Warm/Mostly Lentic
Longnose dace	Yes	Bighorn and Clarksfork Drainages	Nongame	Cool-Warm
Longnose sucker	Yes	Bighorn and Clarksfork Drainages	Nongame	Cool-Warm
Mountain sucker	Yes	Bighorn and Clarksfork Drainages	Nongame	Cool-Warm
Mountain whitefish	Yes	Bighorn and Clarksfork Drainages	Game	Cold/Lotic
Plains killifish	Yes	No	Nongame	Cool-Warm
Plains minnow	Yes	Bighorn Drainage	Nongame	Cool-Warm
Rainbow trout	No	No	Game	Cold/Lentic and Lotic
River carpsucker	Yes	Bighorn Drainage	Nongame	Cool-Warm
Sand shiner	Yes	Bighorn Drainage	Nongame	Cool-Warm
Sauger	Yes	Bighorn Drainage	Game	Cool-Warm/Lentic and Lotic

Table 3-30. Fish Species in the Planning Area (Continued)

Common Name	Native to Wyoming	Native to the Planning Area	Game/ Nongame	Habitat
Shorthead redhorse	Yes	Bighorn Drainage	Nongame	Cool-Warm
Shovelnose sturgeon	Yes	Bighorn Drainage	Game	Cool-Warm/Lentic and Lotic
Smallmouth bass	No	No	Game	Cool-Warm/Lotic and Lentic
Snake river cutthroat trout	Yes	No	Game	Cold/Lentic and Lotic
Stonecat	Yes	Bighorn Drainage	Game	Cool-Warm/Lentic and Lotic
Sturgeon chub	Yes	Bighorn Drainage	Nongame	Cool-Warm
Walleye	No	No	Game	Cool-Warm/Lentic and Lotic
Western silvery minnow	Yes	Bighorn Drainage	Nongame	Cool-Warm
White sucker	Yes	Bighorn Drainage	Nongame	Cool-Warm
Yellow perch	No	No	Game	Cool-Warm/Mostly Lentic
Yellowstone cutthroat trout	Yes	Bighorn and Clarksfork Drainages	Game	Cold/Lentic and Lotic

Source: WGFD 2008

Fishery habitat conditions are closely tied to riparian and watershed conditions and water quality. Riparian vegetation moderates water temperatures, increases bank stability, supports insects used as important food source, filters sediment, provides in stream habitat for fish, and provides organic material for aquatic insects. Indicators of the overall health of fish species include population numbers, water quality, water quantity, bank cover, insect/macroinvertebrate populations, habitat quality, gain or loss of important habitats, rangeland health standards, riparian PFC ratings, disease, and presence of aquatic invasive species including zebra mussels, New Zealand mud snails, Asian clams, Didymo, and Quagga mussels.

Historically, agriculture, vegetation management, fire management, development, surface-disturbing activities, motorized vehicle use, and recreation have influenced fisheries habitat in the Planning Area. With the long-term drought, the total amount of fisheries habitat has declined in some streams. Stream segments that previously had perennial flows have been dewatered for various periods (for example, the upper reaches of Kirby Creek and Nowater Creek). Most of these segments are small streams that supported nongame fish. Some streams that contained trout, such as Grass Creek or Enos Creek, have lost some or all of their trout populations.

Due to the recent drought conditions and increased demands for water in the Planning Area, rivers, streams, and reservoirs have experienced low flows and drawdowns. This directly affects fisheries habitat, spawning success, and survival of fish in both streams and reservoirs. Low streamflows have resulted in the siltation of pools in streams that are needed for fish to survive. Pools that have filled with sediment have not received the spring flushing flows necessary to remove it. These same high flows are also necessary to clean sediment-laden spawning gravels; therefore, fish recruitment rates have decreased. The effects of drought can be quickly reversed in streams with a return to more normal weather patterns; however, although higher streamflows may improve stream pool habitat, they will not remedy the continued siltation of reservoirs. If the drought continues and in turn causes an increase in plant mortality or wildfires, the present sedimentation rate of the reservoirs could increase.

Some activities in the Planning Area are improving fisheries habitat. The Conservation Districts in the Planning Area have had some success in improving water quality through programs encouraging

sprinkler irrigation systems over ditch irrigation systems, relocating corrals and feedlots away from rivers, and replacing septic systems. The net result has been a decrease in sediment from irrigation return flows and coliform bacteria contamination.

Management Challenges

Management challenges for fishery habitats include water depletion, drought, sedimentation, isolated populations, and barriers to migration. Water depletions, through consumptive uses and evaporative loss, are expected to continue to increase and could affect water quality and availability for fish, resulting in decreased population densities and a reduction in recreational fishing opportunities. Habitat improvements and enhancements could offset some of the decline in fisheries habitat, but such opportunities on BLM-administered lands are somewhat limited due to irregular land ownership patterns and an inability to influence water diversions and in-streamflows. The state of Wyoming is administratively responsible for issuing water rights and the maintenance and enforcement of water quality standards in the Planning Area (see Section 3.1.4 *Water*).

Improperly designed or installed culverts can prevent fish migration, disrupt habitat, and decrease spawning success. BLM Manual 9112 and Handbook H-9112, Bridges and Major Culverts, provide guidance on policies and procedures related to the design, construction, and maintenance of bridges and major culverts (BLM 2011e). BLM policy requires that all bridges and major culverts allow fish passage and that installations be coordinated with a BLM fisheries biologist. In designing bridges and culverts, primary consideration is given to the effect the structure would have on the passage of resident or anadromous fish, and in some cases may provide an opportunity to assist in stream management. The BLM designs culverts to promote fish passage on intermittent and ephemeral streams, with priority given to Wyoming DEQ streams that support a Class 1, 2A, 2B, 2AB, and 2C surface waters with designated uses as fisheries (Blue Ribbon and Red Ribbon streams). Lower priority is generally given to Class 3, 3B, and 4 surface waters that support other aquatic life.

Both climate change and short-term variation in weather patterns can contribute to changes in stream systems such as flow, temperature, and turbidity. Aquatic systems are never static, but constantly change in response to environmental variations such as summer heat and winter ice, droughts and floods, and longer-term climatic changes. Lotic systems depend on high-water events to create fish habitat such as scour pools for winter or low-water habitat, large woody debris and undercut banks to create overhead cover, and to clean sediment out of spawning gravels. Living in a dynamic environment, fish tolerate and even need such periodic disruptions to their stream habitats. Such disruptions, if they are too extreme or occur too frequently, can adversely affect fish habitat and can permanently reduce or eliminate fish populations from some stream reaches or stream systems. Many climate-change predictions include increased duration and frequency of droughts and an increase in extreme precipitation events (see Section 3.1.1 *Air Quality*).

In the Planning Area, many of the lotic fish populations survive in isolated systems. Such systems have limited or no ability to be repopulated from other systems if the present population is extirpated. These populations have survived many periodic droughts, but if climate change in the Planning Area results in droughts that are longer and more severe than historic patterns, fish populations and species numbers could be adversely affected.

3.4.6 Fish and Wildlife Resources – Wildlife

The BLM has grouped the wildlife species described in this RMP and EIS according to Wyoming Statutory Wildlife Categories. This section describes existing conditions and management challenges for habitat types and statutory wildlife groups in the Planning Area. Management actions are incorporated in the alternatives and described in more detail in Chapter 2. It is important to note that the management actions are based on wildlife seasonal ranges that change overtime, and the spatial habitat designations will be reviewed and modified as necessary. For purposes of this discussion, the terms habitat and vegetative types are used interchangeably.

Wildlife and Habitats in the Planning Area

There is a diversity of wildlife habitats in the Planning Area, primarily because of its location between three physiographic areas – the Northern Shortgrass Prairie to the north and east, the Central Rocky Mountains to the west, and the Wyoming Basin to the south of and including the Planning Area. Also, the Bighorn Basin is a basin bounded by mountains that affect floral and faunal distribution, which also defines the diversity of habitats and species in the Bighorn Basin.

Lands in the Planning Area contain a variety of habitats that possess the biological and physical attributes important in the life-cycles of many wildlife species. The diversity of habitats and landscapes provide important areas for breeding, birthing, foraging, wintering, and migration. Wildlife and their habitats are representative of Great Basin fauna and flora. Wildlife habitat is best characterized by vegetation types, water resources, geology, and topography. Vegetation types are characterized as successional stages, commonly influenced by disturbance regimes like fire, grazing, and drought. Just as a diversity of vegetation types is important to wildlife, so are these successional stages within types. Habitats in the Planning Area include sagebrush-steppe shrublands, coniferous forests, juniper woodlands, aspen stands, mountain shrub, canyons and rim rock, badlands, grasslands, and riparian/wetland areas. See the Vegetation sections in this chapter for more information about these habitat types in the Planning Area.

Factors such as fire, forestry, ROWs, livestock grazing management, motorized vehicle use, and OHV use and other types of recreation also influence the quality of habitat, as do management actions applied throughout BLM-administered lands. It also is noteworthy that many wildlife populations spend considerable time on non BLM-administered lands and these populations often depend to a great extent on, and are therefore affected by, management of these non BLM-administered lands. Most wildlife species utilize vegetation on the basis of its structure (height and spacing) and the growth form (gross morphology and growth aspect) of the predominant species. Therefore, mapping vegetation zones and successional stages characterizes wildlife habitat in general terms. The BLM manages wildlife habitat in the Planning Area according to a number of HMPs and habitat management recommendations provided through the WGFD *Strategic Habitat Plan* (WGFD 2009a); Table 3-31 lists these HMPs.

Table 3-31. Habitat Management Plans Applicable to the Planning Area

Plan	Year
Absaroka Front Habitat Management Plan (BLM 1986a)	1986
Bighorn River Habitat and Recreation Management Plan (BLM 1987)	1978 (updated 1986)
Grass Creek Resource Area Reservoir Habitat Management Plan (BLM 1983a)	1983
Grass Creek Resource Area Streams Habitat Management Plan (BLM 1984a)	1984
Washakie Resource Area Reservoir Habitat Management Plan (BLM 1994b)	1994
West Slope Habitat Management Plan (BLM 1984b)	1984

Source: BLM 2009a

Habitat in the Planning Area ranges from montane areas in the Absaroka, Owl Creek, and Big Horn Mountains to salt desert shrublands with extensive grassland and shrublands in between. See the *Vegetation* section in this chapter and Section 3.4.3 *Riparian/Wetland Resources* for descriptions of plant communities in the Bighorn Basin.

The Planning Area contains important crucial winter range for a variety of animals. Crucial winter range is often the determining factor in maintaining big game populations at objective levels.

Terrestrial vertebrate wildlife species present in the Bighorn Basin represent all major vertebrate classes–reptiles, amphibians, birds, and mammals. Management emphasis is primarily placed on birds and mammals because of interest in them by the hunting and recreating public. The following paragraphs describe terrestrial wildlife species in the Planning Area. The descriptions are based on WGFD statutory wildlife categories to facilitate discussion regarding these species. The *Special Status Species* section in this chapter addresses species of special concern (threatened, endangered, and sensitive species).

Big Game

Big game species in the Planning Area include pronghorn, deer (mule deer and white-tailed deer), elk, moose, bighorn sheep, and mountain goat. Boundaries of the herd unit areas are established to encompass all the seasonal ranges and habitats or special life-function areas (e.g., calving and lambing areas) utilized by a more or less discreet population or herd. Because there will always be some interchange of animals between adjacent populations, and portions of populations change important use patterns over time, these boundaries are well defined, but not permanent. They do, however, represent the best available data and identify population units consistent with the most recent biological and climatic conditions. Table 3-32 provides information about the relative size and amount of BLM-administered lands in Planning Area big game herd units.

Table 3-32. Relative Size and Amount of BLM-administered Lands Occupied by Big Game Herd Units

Big Game Species	Herd Unit Name	Total Herd Unit Acreage in Wyoming	Herd Unit Acreage in the Planning Area	Herd Unit Percentage in the Planning Area	Herd Unit Acreage on BLM-Administered Lands	Herd Unit Percentage on BLM-Administered Lands
Pronghorn	Badger Basin	885,696	745,721	84	239,812	27
	Big Horn	799,601	798,529	100	576,533	72
	Copper Mountain	1,456,204	1,336,902	92	764,453	53
	Fifteenmile	2,018,619	1,538,985	76	969,576	48
	Carter Mountain	1,342,601	1,158,807	86	625,025	47
	Upper Powder River	525,128	9,832	2	717	0
	Middle Fork	400,009	10,788	3	6,359	2
	Badwater	589,514	38,604	6	1,505	0
	Project	1,947,004	13	0	1	0
	North Natrona	926,307	531	0	302	0
	Total	**10,890,683**	**5,638,712**	**52**	**3,184,283**	**29**
Mule Deer	Paintrock	916,220	679,834	74	470,838	52
	Southwest Bighorns	1,885,331	1,220,337	65	652,523	35
	Basin	779,131	779,131	100	635,668	82
	Greybull River	533,765	533,765	100	362,687	68
	Clarks Fork	969,665	457,903	47	155,121	16
	Upper Shoshone	1,256,363	264,105	21	58,208	5
	Shoshone River	658,972	654,652	99	341,953	52
	Owl Creek/Meeteetse	1,298,422	724,587	56	280,195	22
	North Bighorn	1,583,972	305,456	19	220,830	14
	Upper Powder River	884,217	19,932	2	6,821	1
	North Natrona	926,307	531	0	302	0
	Total	**11,692,365**	**5,640,233**	**48**	**3,185,146**	**27**
White-Tailed Deer	Bighorn Basin	8,163,337	5,591,452	68	3,177,146	39
	Powder River	6,780,256	19,932	0	6,821	0
	Central	8,928,515	531	0	302	0
	Total	**23,872,108**	**5,611,915**	23	**3,184,269**	**13**

Table 3-32. Relative Size and Amount of BLM-administered Lands Occupied by Big Game Herd Units (Continued)

Big Game Species	Herd Unit Name	Total Herd Unit Acreage in Wyoming	Herd Unit Acreage in the Planning Area	Herd Unit Percentage in the Planning Area	Herd Unit Acreage on BLM-Administered Lands	Herd Unit Percentage on BLM-Administered Lands
Elk	Medicine Lodge	923,578	653,690	71	469,709	51
	Gooseberry	1,051,437	577,296	55	238,006	23
	Cody	2,650,742	1,604,469	61	984,440	37
	North Bighorn	1,537,061	305,456	20	220,830	14
	Clark's Fork	1,825,765	1,262,765	69	612,525	34
	South Bighorn	3,654,429	1,236,557	34	659,636	18
	Total	**11,643,012**	**5,640,233**	**48**	**3,185,146**	**27**
Moose	Bighorn Moose	2,661,310	841,547	32	582,891	22
	Absaroka	3,227,185	1,149,359	35	387,397	12
	Total	**5,888,495**	**1,990,906**	**34**	**970,288**	**16**
Bighorn Sheep	Absaroka	4,033,291	1,139,215	28	385,971	10
	Devils Canyon	145,387	94,347	65	70,865	49
	Total	**4,178,678**	**1,233,562**	**29**	**456,836**	**11**
Mountain Goat	Beartooth	956,057	194,644	20	63,799	7
	Total	**956,057**	**194,644**	**20**	**63,799**	**7**

Sources: BLM 1990; BLM 2013a; WGFD 2014.

BLM Bureau of Land Management

The Planning Area contains 2,484,330 acres of crucial winter range for big game, 1,324,371 acres of which is on BLM-administered lands (BLM 2013a) (Map 44). Winter is a crucial and stressful time for big game; therefore, crucial winter range is often the focus of management and a criterion for analyzing the impacts to big game from resource management. There are no feed grounds on BLM-administered lands in the Planning Area. The Planning Area contains all or part of 35 herd units (10 pronghorn, 11 mule deer, 3 white-tailed deer, 6 elk, 2 moose, 2 bighorn sheep, and 1 mountain goat). Appendix K shows the location of WGFD herd units. Specific information about population trends is available through the WGFD via the agency's Job Completion Reports (http://gf.state.wy.us/wildlife/index.asp).

Pronghorn

Pronghorn are a unique animal of the western plains and are the only living species in their taxonomic family (*Antilocapridae*). Wyoming is the center of the pronghorn's range. Pronghorn inhabit a wide variety of open rangeland habitat types throughout the Planning Area and forage primarily on shrubs, especially sage species.

Population projections for pronghorn generally have been below objectives for several years. This is partly due to adverse effects on the quality of the shrub component of their pronghorn habitat in many ranges. Habitat condition of many of the Wyoming big sagebrush communities associated with pronghorn winter ranges is declining due to poor productivity, plant recruitment, old age, and

cheatgrass invasion that has out-competed native herbaceous and sagebrush species. Declines in habitat quality also have affected the reproduction and survival rates for pronghorn. Lower reproduction and lower recruitment of young into populations has inhibited the ability of herd populations to recover from declining numbers.

Deer

Both mule deer and white-tailed deer occur in the Planning Area, although mule deer are by far the more abundant species. Mule deer generally prefer habitat types in the early to mid-stages of plant succession with numerous shrubs. They use the woody riparian, shrublands, juniper woodland, and aspen woodland habitat types extensively during spring, summer, and fall. These habitat types provide adequate forage areas with succulent vegetation for lactating females and adequate cover for security and fawning. During winter, mule deer move to lower elevations to avoid deep snow that covers their forage. They are often found in juniper and limber pine woodlands, big sagebrush/rabbitbrush, sagebrush steppe, and riparian habitat types. Mule deer success is linked to the amount and quality of habitat required to meet their needs to reproduce successfully and to survive. Habitats used by deer are changing (Gill 1999). Mule deer are generally declining in numbers due to a decline in habitat quality and quantity. Mule deer populations are generally below WGFD-objective numbers throughout the Planning Area (see link above to WGFD Job Completion Reports).

White-tailed deer use woody riparian habitats (willow and cottonwood) along major creeks and rivers for both forage and cover. They are found mainly on private lands in the Planning Area. White-tailed deer are expanding into new areas, but it is not clear if the population is actually increasing or whether it is spreading into expanded habitat types. White-tailed deer have been affected by periodic disease outbreaks that have caused short-term, localized population declines, but overall have shown population increases.

Elk

Elk are distributed throughout the Planning Area, especially adjacent to and in areas of higher elevation that have forest or woodland cover. In summer, elk use aspen and conifer woodlands for security and thermal cover, ranging out into upland meadows, sagebrush/mixed grass, and mountain shrub habitat types to forage. In winter, elk move to lower elevations, foraging especially in sagebrush/mixed grass, and mountain shrub habitat types, and in windswept areas where snow is less deep. Elk depend on these habitats in designated crucial winter ranges to maintain populations at objective levels. For calving, elk move into areas that provide particularly good hiding cover and succulent forage.

Elk numbers have been generally at or over objective for most herd units in the Bighorn Basin for the past two decades. Elk have possibly fared better because they are more generalist feeders than species like deer and pronghorn.

Moose

Moose are distributed in low densities throughout the Absaroka, Owl Creek, and Big Horn Mountains in the Planning Area, especially along the river and stream corridors adjacent to these mountains and in areas of higher elevation that have forest or woodland cover. In summer and fall, moose use willow, aspen, and mixed conifer forests for forage and security. Moose are primarily browsers and feed on woody species like willow, aspen, and some young conifer species. In winter, moose in the Big Horn Mountains seem to concentrate primarily in riparian corridors and mixed conifer habitats, while in the Absaroka Mountains they tend to move up in elevation to forage in mixed conifer and spruce/fir forest habitat types. Occasionally, severe winter snows push moose to lower elevations. Moose populations are generally below WGFD-objective numbers.

Bighorn Sheep

Bighorn sheep are present predominantly in the Absaroka Mountains, Owl Creek Mountains, and the Devil's Canyon and Shell Canyon areas of the Big Horn Mountains. Populations in the Pryor Mountains across the border in Montana occasionally move into the Planning Area.

Bighorn sheep prefer open grassy ridges, slopes, or benches close to escape cover in the form of rocky outcrops, precipitous cliffs, or steep rocky slopes. They most commonly prefer herbaceous forage and typically use alpine meadows and mountain shrub habitat types, primarily foraging on forbs and grasses and converting to browsing on shrubs when snow depths dictate.

Bighorn sheep also are known to be susceptible to *Pasteurella sp.* bacteria commonly carried within the nasal cavities of domestic sheep and domestic goats. *Pasteurella*, when transferred, usually through nose to nose contact, causes sickness and death, and has caused the decline of numerous bighorn sheep populations.

The Wyoming Statewide Bighorn/Domestic Sheep Interactions Working Group has designated areas of Wyoming as bighorn sheep native core areas, cooperative review areas, and non-emphasis areas. The western edge of the Bighorn Basin is generally considered a core area and the eastern edge is a non-emphasis area.

Bighorn sheep populations in the Planning Area have increased due to the establishment of native core areas in occupied bighorn sheep habitat and because of habitat augmentation and improvement through burning and livestock permit changes.

Mountain Goat

There are mountain goats on BLM-administered lands near Clarks Fork of the Yellowstone River canyon, predominantly in high, steep and rocky habitat. This habitat provides escape cover and shelter from the wind and storms coming off the Beartooth Plateau. It also is lower in elevation than predominantly spring and summer habitat that is higher on the Beartooth Plateau.

Mountain goat populations are stable in the Planning Area. There is one herd unit in the Planning Area, which has been hunted, and harvests are adjusted to maintain a stable, local population.

Management Challenges

Management challenges for big game species include poor habitat conditions, wildfires, drought, increased development and urbanization, habitat fragmentation, motorized vehicle misuse, disease, hunter access, and the impacts of improper livestock grazing management on the frequency, quality, and composition of key forage species. The WGFD monitors disease in big game species. The BLM and the WGFD continually coordinate and evaluate actions affecting herd units and habitat conditions to determine the appropriate management direction.

Big game species that depend on woody plant communities (e.g., pronghorn, mule deer, and moose) are generally declining in numbers due to a decline in habitat quality and quantity (see Section 3.4.1 *Vegetation – Forests, Woodlands, and Woodland Products*). Species that depend on herbaceous plants (e.g., elk and bighorn sheep) generally have stable or increasing populations.

Trophy Game

The WGFD classifies cougar, black bear, grizzly bear, and gray wolves as trophy animals. Cougars are typically found in remote areas with dense cover and rocky, rugged terrain. They are found in most

habitats where deer, their primary prey base, are present. Black bear are found throughout both the foothills and mountains of the Absaroka front and the Big Horn Mountains, with occasional occurrences along riparian corridors such as the Greybull, Bighorn, and Nowood rivers. They are typically associated with forested and riparian habitats in higher precipitation zones. Grizzly bear are found in the Absaroka and Beartooth mountain areas and have been observed along the western part of the Owl Creek Mountains. Section 3.4.9 *Special Status Species – Wildlife* addresses the grizzly bear and gray wolf.

In the Planning Area, there are management areas for cougar (throughout) and black bear (Absaroka, Owl Creek, and Big Horn Mountains). These represent areas where populations of these species are sufficient to support hunting and to warrant hunting management. Black bear populations are fairly stable and cougars appear to be expanding into a few new areas. However, due to the reclusive nature of black bears and cougars, it is difficult to estimate population. For additional information on trophy game, refer to the WGFD website, http://gf.state.wy.us/.

Furbearing Animals

Badger, beaver, bobcat, marten, mink, muskrat, and weasel are classified as furbearing animals and are found throughout the Bighorn Basin. Population figures for furbearing animals are available only on a statewide basis. Trapping seasons apply to most furbearers; badgers are taken year-round, while others are typically trapped in early winter (bobcat, muskrat, mink, and weasel). Trapping dates vary for beaver and marten.

Beaver, mink, and muskrat populations have likely declined across much of the Planning Area due to drought conditions. Water volumes have decreased in many riparian systems from a loss of water storage capability and from a lack of precipitation. The distribution of mink and muskrat populations has shrunk due to a loss of water in some riparian systems. Beaver depend on aspen, willow, and cottonwood trees to build and maintain their dams and lodges. Conifer trees have invaded many riparian areas adjacent to streams due to drying of these sites from a drop in the water table. Conifers take up available water and space, both surface and subsurface, choking out aspen, willow, and cottonwood communities.

Predatory Animals

According to Wyoming statute, predatory animals include jackrabbit, porcupine, coyote, gray wolf, red fox, raccoon, and skunk. Section 3.4.9 *Special Status Species – Wildlife* addresses the gray wolf. All of these species can be found in the Planning Area. From the standpoint of BLM management, most management efforts and attention focus on coyote, red fox, and skunk damage-control activities. The BLM does not conduct any habitat management activities for predatory animals.

USDA APHIS-Wildlife Services performs predatory animal damage-control activities on public lands, and performs these activities in response to requests from individuals, organizations, and agencies experiencing damage caused by wildlife. Animal damage-control activities primarily include mechanical (trapping, shooting, and denning), chemical (poison), and nonlethal methods (e.g., noise devices and aversive conditioning). Through the Animal Damage Management Board, the state of Wyoming also performs animal damage-control activities, particularly actions involving rabies and other diseases.

Management challenges for animal damage-control activities are to implement a program that responds to predation problems and remains socially acceptable and safe in accordance with applicable laws and regulations. Predator populations typically follow prey populations, particularly when the relationship is prey specific.

Small Game

Small game includes cottontail rabbits, snowshoe hare and fox, and gray and red squirrels. Cottontails, snowshoe hares, and squirrels are found throughout the Planning Area and are hunted from early to mid-winter. Snowshoe hare are found in transition areas adjacent to conifer forest and are indicator species for Canada lynx habitat. Cottontail and white-tailed jackrabbits occur in many habitat types and are broadly distributed in the Bighorn Basin. Red squirrels are found in conifer and mixed forest habitats, generally at higher elevations. There are no available estimates of population size, mortality, and natality rates for these species.

Rabbit and squirrel populations are cyclic, so trends are difficult to determine, however, populations appear to be generally stable. Information regarding hunter days and harvest are available from the WGFD. Snowshoe hare are present in wetter forests, which occur in limited BLM-administered areas. This prey species is important for Canada lynx reproduction and survival.

Game Birds

Game bird management direction for the BLM is identified in the BLM *Fish and Wildlife 2000: Upland Game Bird Habitat Management* (BLM 1992a). All game bird species in Wyoming are managed for recreational use such as hunting and bird watching.

Upland game birds in the Planning Area include pheasant, chukar, gray partridge, blue grouse, ruffed grouse, greater sage-grouse, and turkeys. Section 3.4.9 *Special Status Species – Wildlife* discusses the greater sage-grouse. The forest-woodland edges adjacent to Bighorn and Shoshone National Forests support appreciable stands of preferred habitat that supports populations of blue and ruffed grouse. Chukar and gray partridges are found in hilly and rolling terrain along mountain foothills and to some extent in badland topography in lower elevations of the Bighorn Basin; the best chukar partridge habitat is along the west slope of the Big Horn Mountains in the canyons and foothills. Gray partridge are found in similar foothills and badlands habitat types in the Bighorn Basin. Pheasants are found primarily in habitat associated with riparian areas or corridors, and near or along agricultural fields.

Waterfowl

Ducks and geese occur in aquatic areas throughout the Bighorn Basin. A small number of species breed, winter, or remain yearlong in the state, while larger numbers pass through during spring or fall migration. The entire Bighorn Basin is within the Central Flyway (east of the continental divide). The various sources of water, natural lakes, streams, and manmade reservoirs are important resting areas for a variety of ducks, geese and shorebirds. Waterfowl species include ducks, geese, coots, snipe, and rails. Scattered aquatic resources found throughout the Bighorn Basin support various waterfowl species during nesting periods, and private agricultural lands provide important foraging habitat where grains and hay are grown. Most of these species depend on wetlands or open water that is sufficiently shallow to support rooted vegetation, and they feed on the biotic communities in such habitats.

One important waterfowl habitat is the Bighorn River, primarily because the southern reaches of this river remain open during winter. Many small ponds and reservoirs that have stable water levels have wetlands along their shores. In addition, pools in the numerous streams and their tributaries throughout the Planning Area provide important habitat. Only some of these aquatic resources are on BLM-administered public lands.

As a result of livestock grazing management practices, some riparian zones on public land adjacent to streams, small reservoirs, and ponds have been degraded. This results in the removal of nesting cover

for waterfowl and shorebird species that could nest in these riparian zones. There are several large wetland areas in the Bighorn Basin with large amounts of BLM-administered public land that are protected from or have controlled livestock grazing. These include the Yellowtail Wildlife Habitat Management Area (WHMA), Bighorn River tracts, Wardell and Harrington Reservoirs, Loch Katrine, Renner Habitat Management Area, and several smaller fenced reservoirs that provide good nesting habitat for waterfowl and shorebirds.

Nongame Species

Nongame species include raptors, migratory birds, mammals, and reptiles and amphibians. Such species are numerous and diverse, especially given the diversity of habitats present in the Planning Area. This section addresses only a few of these species or groups. Many nongame species are on the BLM Wyoming State Director's Sensitive Species List; Section 3.4.9 *Special Status Species – Wildlife* addresses those species. The hundreds of additional bird species that inhabit the Bighorn Basin for all or part of their life-cycles are important components of the ecosystem and an important focus of the large segment of recreationists who enjoy bird-watching.

Raptors

Raptor species (eagles, hawks, owls, falcons, and vultures) in the Bighorn Basin include osprey, red-tailed hawk, Swainson's hawk, ferruginous hawk, northern harrier, goshawk, Cooper's hawk, sharp-shinned hawk, rough-legged hawk, golden eagle, bald eagle, merlin, kestrel, peregrine falcon, American kestrel, prairie falcon, great-horned owl, long-eared owl, short-eared owl, great gray owl, and burrowing owl. Some raptors are sensitive to disturbance and occupy an ecological position at the top of the food chain; thus, they can act as biological indicators of environmental quality. Section 3.4.9 *Special Status Species – Wildlife* further discusses several of these species. Raptors are present in habitats throughout the Planning Area.

Most species have specific nest-site requirements, which are key factors in nest-site selection and in reproductive success. These generally include nesting strata, available prey base, and nest-site disturbance. Nests can occur in a myriad of habitats, including on steep cliffs and rock ledges, in trees, and on the ground. Raptors also use manmade structures such as barns, utility poles, and tanks for nesting. The nesting-reproductive season is considered the most critical period in the raptor life-cycle because it determines population productivity.

Many raptors concentrate their nests along a cliff and use this stratum for nesting year after year. These high-use/high-density raptor nesting sites are called raptor concentration areas. Golden eagles and prairie falcons usually build their nests on steep cliffs and rock ledges, and often, red-tailed hawks, great-horned owls, and American kestrels build on these sites.

Numerous raptors in the Planning Area typically nest in trees. Cooper's hawks and sharp-shinned hawks usually nest in lodge pole, mixed conifer forests, or aspen woodlands. Swainson's hawks prefer the more open plains area and usually nest in trees along drainage courses. Most nests in the Bighorn Basin, including most documented red-tailed hawk nests, are in cottonwood trees. Large cottonwood trees along major river corridors also are important nest sites for bald eagles. Northern harriers are ground nesters, but are generally associated with riparian/wetland sites and nest in marsh habitats.

At present, there is no population data for raptor populations; however, the golden eagle population and osprey sightings and nests appear to be increasing throughout the Planning Area.

Raptor habitat protection has been directed toward long-term nest-site protection and minimizing habitat disturbance around nesting sites during the critical nesting period. Raptor nesting stipulations have been applied to surface-disturbing activities such as ROWs and oil and gas leasing. Current stipulations consist of buffer zones around nests, season restrictions on human activities, and "raptor proofing" electrical transmission facilities to prevent electrocution of raptors.

Sensitivity to disturbance varies among individual pairs and species. Nesting pairs that choose to nest near an existing disturbance are probably less apt to abandon the nest than a pair disturbed by new activity.

Migratory Birds

This category includes shorebirds, water birds, and songbirds. A myriad of these species are found throughout the Bighorn Basin. Every plant community type in the Planning Area supports migratory bird species. Riparian/wetland communities typically have the most diverse array of species.

There are no population estimates for most avian species; however, the USFWS has been organizing and conducting breeding bird surveys that provide some data on species occurrence and trend. In addition, the BLM has some observation and occurrence data for some species. In general, habitat-specific information related to migratory birds is incomplete or unknown and population status is undetermined. Degradation, fragmentation, and loss of native sagebrush landscapes have caused relatively large migratory bird declines in the important sagebrush habitat type across the West (Knick et al. 2003).

Sagebrush obligate species populations have been declining, as indicated by the presence of these species on the BLM Sensitive Species List (BLM 2010b) and WGFD Species of Greatest Conservation Need List (WGFD 2005a). Juniper obligate species have stable to upward trends due to the increase in juniper communities.

Mammals

Nongame mammals include species such as mice, rats, voles, ground squirrels, shrews, bats, and prairie dogs. These species are found in habitats throughout the Bighorn Basin. White-tailed prairie dog surveys from 2001 to 2005 in the northern portion of the Bighorn Basin found a 37 percent decrease in the number of towns (105 to 66) and a 71 percent decrease in occupied area (164 acres to 74 acres) from 1980 to 1989 surveys. The black-tailed prairie dog population increased slightly over the same time period but may be vulnerable due to its small size and isolation from the rest of the species' range (Harrell and Marks 2009). There have been bat surveys in suitable caves, mines, and shafts in the Planning Area. There are several known maternity roosts and hibernacula identified in the Planning Area, primarily natural caves that are common in limestone karst areas along the Big Horn Mountains. There is one complex of black-tailed prairie dogs in the Planning Area, and this group of animals is isolated from other populations outside the area. Black-tailed prairie dogs and special status bat species are discussed further in Section 3.4.9 *Special Status Species – Wildlife*.

Reptiles and Amphibians

There is little documentation regarding native reptiles and amphibians in the Bighorn Basin. No estimates of population size are available for any of these species. Some of the reptile species encountered in the Bighorn Basin include greater short-horned lizard, northern sagebrush lizard, eastern yellow-bellied racer, bullsnake, rubber boa, intermountain wandering gartersnake, and prairie

rattlesnake. Amphibian species include tiger salamander, plains spadefoot toad, great basin spadefoot toad, boreal toad, northern leopard frog, spotted frog, and boreal chorus frog. Several species are on the Wyoming BLM Sensitive Species List due to an historical reduction in suitable riparian/wetland habitat and various other factors related to the ongoing general global decline in amphibians (refer to Section 3.4.9 *Special Status Species – Wildlife*).

It is estimated that the trend for reptiles is downward, but this is difficult to confirm because there are no population estimates for these species in the Planning Area. Due to the number of species that are on the Wyoming BLM Sensitive Species List and on the WGFD Species of Greatest Conservation Need List, and the declining condition of suitable habitat on public lands, the BLM assumes that amphibians are generally on a downward trend.

Special Status Species

Several policies and agreements guide management of special status species and their habitat in the Planning Area. In March 1990, the WGFD and the BLM signed an MOU (WGFD and BLM 1990), the purpose of which is to strengthen the agencies' cooperative approach to managing wildlife and wildlife habitat on public land and to encourage the agencies to work together to develop, enhance, maintain, and manage wildlife resources, including planning and sharing data concerning biological resources.

The BLM Wyoming Sensitive Species Policy and List is prepared to focus species management efforts on maintaining habitats for these species (BLM 2010b). The goals of this policy include:

- Maintaining vulnerable species and habitat components in functional BLM ecosystems.
- Ensuring sensitive species are considered in land-management decisions.
- Preventing a need for species listing under the ESA.
- Prioritizing needed conservation work with an emphasis on habitat.

Special status wildlife species are governed under BLM Manual 6840 states that BLM sensitive species will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA (BLM 2008e). In addition, management actions for federally listed species are often derived through the consultation process (i.e., Section 7 of the ESA).

The USFWS provides regulatory oversight for all species that are listed, proposed for listing, or are candidates for listing under the ESA. The USFWS also administers designation of critical habitat for listed species and the Migratory Bird Treaty Act, which protects migratory bird species whether they are hunted (e.g., waterfowl) or not (e.g., songbirds). The USFWS oversees management of federally listed species and the designation of critical habitats in accordance with the ESA. Formal consultation is required on any action a federal agency proposes that (1) may adversely affect a federally listed species or (2) will result in jeopardy or adverse modification of critical habitats. Informal consultation is required on any action a federal agency proposes that (1) may affect – not likely to adversely affect or (2) may affect – may have beneficial effects. Special status species discussed in this section include those species listed as threatened or endangered, those that are proposed for listing, those that are candidates for listing, and those the BLM State Director has designated as sensitive.

The BLM is responsible for managing habitat; state and federal wildlife management agencies oversee the management of special status wildlife and fish species. The WGFD manages resident special status fisheries and wildlife populations and waterfowl in the Planning Area.

3.4.7 Special Status Species – Plants

In the Bighorn Basin, the BLM determines the presence of special status plant species through inventory within likely habitats during site-specific project-level analysis. Restrictions in areas with known populations of special status plants are also determined during site-specific project-level analysis. The Wyoming Natural Diversity Database maintains a list of Wyoming plant species of special concern and provides information on global and state abundance, legal status, and state distribution. Species in Wyoming are considered to be of special concern if (1) the species is vulnerable to extinction at the global or state level due to inherent rarity, (2) the species has experienced a substantial loss of habitat, or (3) the species is sensitive to human-caused mortality or habitat disturbances.

The BLM is responsible for managing habitat and populations of special status plant species. Special status species considered in this analysis are those listed as threatened or endangered under the ESA, those proposed for listing or that are candidates for listing under the provisions of the ESA, and those the BLM State Director or the state of Wyoming have designated as sensitive.

One threatened species, Ute ladies'-tresses, could occur in the Planning Area; 11 BLM sensitive species are known to occur. Of the 11 BLM sensitive species, eight are also Wyoming plant species of concern and one is a Wyoming plant species of potential concern. In addition, the following plants are Wyoming species of concern that are not threatened or endangered and do not appear on the BLM Sensitive Species List: Big Horn fleabane, Cary's beardtongue, hairy prince's plume, and Hapemans' coolwart. These species are listed in the Natural Diversity Database, which the University of Wyoming maintains, and are not further discussed in this section.

Special status plant species are found in a variety of habitats in the Planning Area. The landscape in the area exhibits diverse climates, topography, and soils. Table 3-33 lists habitat associations for special status plants that are known to occur or may be found on BLM-administered land in the Planning Area.

Table 3-33. Special Status Plant Species Habitat in the Planning Area

Common Name	Habitat	Status
Ute ladies'-tresses	Mesic to wet riparian meadows, marshes, stream banks between 4,300 and 5,900 feet amsl.	Threatened
Absaroka beardtongue	Sparsely vegetated openings on steep slopes of loose volcanic rubble or outcrops of dry andesitic volcanic rock at 5,920 to 10,000 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Dubois milkvetch	Barren shale, badlands, limestone, and redbed slopes and ridges at 6,900 to 8,800 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Evert's wafer-parsnip	Coarse volcanic soils or sandstone outcrops dominated by cushion plants or sparse shrublands in openings within Rocky Mountain juniper or limber pine woodlands at 5,900 to 10,900 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Hyattville milkvetch	Sparsely vegetated stony ridges and barren red clay slopes 4,900 to 5,900 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Limber pine	Timberline and at lower elevation with sagebrush.	BLM Sensitive Plant Species
Persistent sepal yellowcress	Riverbanks and shorelines, usually on sandy soils near high water line.	Wyoming Plant Species of Potential Concern BLM Sensitive Plant Species
Rocky Mountain twinpod	Sparsely vegetated rocky slopes of limestone, sandstone or clay 5,600 to 8,300 feet amsl.	Wyoming Plant Species of Potential Concern BLM Sensitive Plant Species
Shoshonea	Shallow, stony calcareous soils of exposed limestone outcrops, ridgetops, and talus slopes 5,900 to 9,200 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Whitebark pine	Montane forests and on thin, rocky, cold soils at or near timberline at 4,265 to 12,139 feet amsl.	Candidate for Listing BLM Sensitive Plant Species
William's wafer-parsnip	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides 6,000 to 8,300 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species
Wyoming tansymustard	Sparsely vegetated sandy slopes at base of cliffs of volcanic breccias or sandstone 8,300 to 10,000 feet amsl.	Wyoming Plant Species of Concern BLM Sensitive Plant Species

Sources: USFWS 2013b; BLM 2010b; BLM 1998b; BLM 1999.

amsl above mean sea level
BLM Bureau of Land Management

Most of the trends and activities that affect other plant species in the Planning Area also affect special status species. These include habitat degradation and fragmentation, grazing practices and management, invasive species, motor vehicles, and climate. These plants are on the BLM Sensitive Species List to ensure actions on BLM-administered lands consider the welfare of these species and minimize the likelihood and need for listing of any other special status species under the provisions of the ESA. The following paragraphs briefly describe each of the 12 special status plant species. Unless otherwise noted, specific information on trends and occurrences for each of the species is not available.

Ute Ladies'-tresses

Ute ladies'-tresses is a federally threatened plant species. This species occurs in mesic to wet riparian meadows, marshes, and stream banks between 4,300 and 5,900 feet amsl. Typical settings for Ute ladies'-tresses can include gravel bars, wet meadow terraces, oxbows, seeps, springs, fens, lakes, and potentially ditches and quarries (Heidel 2007).

Absaroka Beardtongue

The Absaroka beardtongue is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in sparsely vegetated openings on steep slopes of loose volcanic rubble or outcrops of dry andesitic volcanic rock at 5,920 to 10,000 feet amsl. Typical settings for Absaroka beardtongue include very barren, steep slopes with little competition from other vegetation (Mills and Fertig 2000a). Absaroka beardtongue is known to occur in the Absaroka Range of northwest Wyoming (Mills and Fertig 2000a).

Dubois Milkvetch

Dubois milkvetch is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in barren shale, badlands, limestone, and redbed slopes and ridges at 6,900 to 8,800 feet amsl. Typical settings for Dubois milkvetch include mid to upper slopes near the crest of badland ridges or low knolls (Fertig 2000a).

Evert's Wafer-parsnip

Evert's wafer-parsnip is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in coarse volcanic soils or sandstone outcrops dominated by cushion plants or shaded rock outcrops and ridges adjacent to Rocky Mountain juniper or limber pine woodlands at 5,900 to 10,900 feet amsl (Fertig 2000b).

Hyattville Milkvetch

Hyattville milkvetch is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in sparsely vegetated stony ridges and barren red clay slopes at 4,900 to 5,900 feet amsl. Hyattville milkvetch is mostly found on outcrops of the Goose Egg and Chugwater formations with some beds of Ten Sleep Sandstone; plants are usually absent from gypsum-rich deposits (Fertig 2001). Hyattville milkvetch is found on the eastern rim of the Bighorn Basin and western foothills of the Big Horn Range near Hyattville, Wyoming (Fertig 2001).

Limber Pine

Limber pine is a BLM sensitive plant species. This species occurs in high montane forests, often at timberline (Flora of North America 1993a). It occurs at elevations of 4,900 to 11,000 feet amsl (Flora of North America 1993a). Species associated with limber pine include Rocky Mountain lodgepole pine, Engelmann spruce, whitebark pine, Rocky Mountain Douglas-fir, subalpine fir, Rocky Mountain juniper, mountain mahogany, and common juniper.

Persistent Sepal Yellowcress

Persistent sepal yellowcress is a BLM sensitive plant species and a Wyoming plant species of potential concern. This species occurs on moist, sandy to muddy riverbanks and shorelines, usually near the high water line (Handley and Heidel 2008).

Rocky Mountain Twinpod

Rocky Mountain twinpod is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs on sparsely vegetated rocky slopes of limestone, sandstone or clay at 5,600 to 8,300 feet amsl. Rocky Mountain twinpod is endemic to the Bighorn Basin and Absaroka Range (Mills and Fertig 2000b).

Shoshonea

Shoshonea is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in shallow, stony calcareous soils of exposed limestone outcrops, ridgetops, and talus slopes at 5,900 to 9,200 feet amsl. Shoshonea is associated with other low-growing forbs and cushion plants on sites with sparse cover (Fertig and Mills 2000). Shoshonea is known to occur in the eastern Absaroka and Owl Creek Mountains (Fertig and Mills 2000).

Whitebark Pine

Whitebark pine is a candidate species for listing of protection under the ESA and a BLM sensitive plant species. This species occurs on thin, rocky, cold soils at or near timberline in montane forests (Flora of North America 1993b).

William's Wafer-parsnip

William's wafer-parsnip is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs on open ridgetops and upper slopes with exposed limestone outcrops or rockslides at 6,000 to 8,300 feet amsl. Soils tend to be thin and sandy, and often restricted to small cracks in the limestone bedrock (Fertig 2000c). William's wafer-parsnip is restricted to the Big Horn Mountains (Fertig 2000c).

Wyoming Tansymustard

Wyoming tansymustard is a BLM sensitive plant species and a Wyoming plant species of concern. This species occurs in sandy soil at the base of cliffs composed of volcanic breccias or sandstone (Fertig 2000d) at elevations of 8,300 to 10,000 feet amsl.

Management Challenges

Management challenges for special status plant species in the Planning Area include preventing declining population trends for select species; occurrence of drought; spread; not maintaining PFC for riparian/wetland habitats; vegetation treatment with prescribed fire or herbicides; lack of periodic disturbance events (e.g., fire, flood, and grazing); physical trampling (e.g., from OHV use); loss of habitat resulting from altered hydrology; and challenges presented by special status plant populations occurring over multiple land ownerships. While threats to some species might remain low due to remote habitat, threats to other species might increase despite distance or restricted access. For example, special status plant species that depend on groundwater levels could be affected by upstream depletions of groundwater far removed from affected plant populations. In addition, early successional special status

plant species protected from habitat alteration could still be adversely affected by natural succession and the lack of fire, flooding, or other disturbance factors necessary to retain early successional habitat.

3.4.8 Special Status Species – Fish

Fisheries habitats in the Planning Area include perennial and intermittent streams that support fish through at least a portion of the year. See Section 3.1.4 *Water* for a description of surface-waterbodies in the Planning Area.

Special status fish species are listed as endangered or threatened, or are proposed or candidate species for listing under the ESA. Special status fish species also include those designated as BLM sensitive species or state of Wyoming species of concern. No federally listed fish species are known to occur in the Bighorn Basin; however, the Bighorn River and the Clarks Fork of the Yellowstone River both drain into the Yellowstone River, which supports listed species downstream. See Section 3.4.5 *Fish and Wildlife Resources – Fish* for more information on fishery resources in the Planning Area.

The Yellowstone cutthroat trout is the only BLM sensitive fish species and only native trout found in the Planning Area. There is Yellowstone cutthroat trout habitat in the Wind/Bighorn and Yellowstone drainage. This species is found in many headwater streams of the Bighorn, Greybull, Shoshone, and Clarks Fork of the Yellowstone river drainages.

Three other game species of concern are known to occur in the Planning Area – the burbot, sauger, and shovelnose sturgeon. Burbot and sauger are found in Boysen Reservoir and downstream in Bighorn River to Yellowtail Reservoir. In the 1990s, the shovelnose sturgeon was reintroduced to the Bighorn and Greybull rivers, part of its historic range (WGFD 2005b).

Management Challenges

Threats to special status fish species are similar to those for other fish species and can include water depletion, barriers to migration, drought, and degraded habitat conditions. See Section 3.4.5 *Fish and Wildlife Resources – Fish* for more information regarding management challenges and objectives.

Water depletions upstream can change the velocity, volume, and timing of downstream river water flows. Historically, water development projects (i.e., dams, reservoirs, water and sediment control basins, irrigation diversions, sand and gravel mining, and wetland creation) have altered historic surface water hydrographs (i.e., water flow timing, volume, and velocity) in the Missouri River ecosystem through consumption, evaporation, or by altering the timing of water flows.

3.4.9 Special Status Species – Wildlife

Special status species are those listed as threatened, endangered, proposed, or candidates for listing under the provisions of the ESA and those the BLM State Director designates as sensitive. Special status wildlife species in the Planning Area inhabit a variety of habitat types, including sagebrush shrublands, grasslands, and riparian/wetland habitats. Comprehensive data on population numbers and distribution within the Planning Area are not available for most special status species.

One endangered wildlife species (black-footed ferret), two threatened wildlife species (grizzly bear and Canada lynx), one proposed species (North American wolverine), one candidate species (greater sage-grouse), and one experimental nonessential species (gray wolf) have been or are known to occur in the Planning Area. Twenty-six BLM sensitive species are known to occur or have potential habitat in the

Planning Area. Table 3-34 and the discussion of special status wildlife species in this section are organized by the applicable Wyoming statutory categories (see Section 3.4.6 *Fish and Wildlife Resources – Wildlife*). Table 3-34 identifies all special status wildlife species that (1) occur in, (2) have potential habitat in, or (3) could be influenced by activities in the Planning Area. Table 3-34 also summarizes status and general habitat for each special status wildlife species. The BLM uses HMPs to focus habitat management for special status and other species in the Planning Area. There is no critical habitat in the Planning Area.

Most of the trends that affect other species of wildlife in the Planning Area also affect special status species. These include habitat degradation and fragmentation; livestock, wildlife, and ungulate grazing and browsing; invasive species; motor vehicles; and climate.

Table 3-34. Special Status Wildlife Species Habitat in the Planning Area

Common Name	Habitat	Status
Trophy Game		
Grizzly bear	Woodlands, forests and alpine.	Threatened
Game Birds		
Greater sage-grouse	Sagebrush habitats.	Candidate for listing
Nongame Raptors		
Bald eagle	Large bodies of open water such as lakes, marshes, and rivers where there is an abundance of fish and tall trees to roost.	BLM sensitive species
Burrowing owl	Open, dry grasslands, agricultural lands, rangelands, and desert habitats often associated with burrowing animals.	BLM sensitive species
Ferruginous hawk	Arid and semiarid grassland regions with open, level, or rolling prairies. Foothills or middle elevation plateaus largely devoid of trees, and cultivated shelterbelts or riparian corridors.	BLM sensitive species
Northern goshawk	Forested areas and open areas near forested areas.	BLM sensitive species
Peregrine falcon	Found in a variety of habitats, most with cliffs for nesting and open areas for foraging.	BLM sensitive species
Nongame Migratory Birds		
Baird's sparrow	Native mixed-grass and fescue prairie.	BLM sensitive species
Brewer's sparrow	Northern Rocky Mountains including sagebrush and alpine meadows.	BLM sensitive species
Loggerhead shrike	Grasslands interspersed with scattered trees and shrubs that provide nesting and perching sites.	BLM sensitive species
Long-billed curlew	Plains, grasslands, and prairies.	BLM sensitive species
Mountain plover	Short-grass prairie dominated by the blue grama (*Bouteloua gracilis*). Also can be found in taller grasses that have been grazed or associated with prairie dog colonies.	BLM sensitive species
Sage sparrow	Sagebrush flats, alkaline flats with saltbush, and semi-desert shrublands in the lowlands.	BLM sensitive species

Table 3-34. Special Status Wildlife Species Habitat in the Planning Area (Continued)

Common Name	Habitat	Status
Sage thrasher	Open, shrub-steppe country dominated by sagebrush or bitterbrush, with native grasses intermixed, generally avoiding cheatgrass-dominated landscapes.	BLM sensitive species
Trumpeter swan	Ice-free water in estuaries and sheltered coastlines. Rocky Mountain flock concentrate in the Greater Yellowstone Ecosystem, where geothermal activity prevents freezing.	BLM sensitive species
White-faced ibis	Shallow lake waters, muddy ground of wet meadows, marshes, ponds, lakes, rivers, flooded fields, and estuaries.	BLM sensitive species
Yellow-billed cuckoo	Woodlands with clearings and dense scrubby vegetation, often along water.	BLM sensitive species
Nongame Mammals		
Black-footed ferret	Shortgrass and midgrass prairies in close association with prairie dog colonies.	Endangered
Canada lynx	Coniferous forests at higher elevation, with substantial winter snow accumulations.	Threatened
Gray wolf	The gray wolf has thrived in many different environments, but primarily forested areas.	BLM sensitive species
North American wolverine	Rocky Mountain subalpine and alpine habitats.	Proposed for listing
Long-eared myotis	Coniferous forests in mountain areas. Roosts in small colonies in caves, buildings, and under tree bark.	BLM sensitive species
Spotted bat	Prominent rock features in extreme, low desert habitats to high elevation forests.	BLM sensitive species
Townsend's big-eared bat	Mines, caves, and structures in woodlands and forests to elevations above 9,500 feet amsl.	BLM sensitive species
White-tailed prairie dog	Altitudes ranging between 4,000 to 8,000 feet amsl in desert grasslands and shrub grasslands.	BLM sensitive species
Black-tailed prairie dog	Inhabits dry, flat, open, shortgrass and mixed-grass grasslands with low, relatively sparse vegetation, including areas overgrazed by cattle.	BLM sensitive species
Nongame Amphibians		
Boreal toad	Marshes, springs, creeks, small lakes, meadows, woodlands, forests, and desert riparian areas.	BLM sensitive species
Columbia spotted frog	Marshes, springs, creeks, small lakes, and meadows.	BLM sensitive species
Great basin spadefoot toad	Arid or semiarid regions usually with open habitats such as desert brush and grasslands.	BLM sensitive species
Northern leopard frog	Permanent ponds, swamps, marshes, and slow-moving streams throughout forest, open, and urban areas. Waterbodies with abundant aquatic vegetation.	BLM sensitive species

Source: BLM 2010b

amsl above mean sea level
BLM Bureau of Land Management

Trophy Game

The grizzly bear, a BLM threatened species, is the only trophy game special status species in the Planning Area. Grizzly bears are found in the Absaroka and Beartooth mountain areas and have been observed along the western part of the Owl Creek Mountains. Along the Absaroka Front there has been an expansion of grizzly bear range, primarily in the spring and fall, due to increased federal protection, and in some cases forage shortages (pine nuts, moths, Yellowstone cutthroat trout, and berries) during drought years. There has also been an expansion of grizzly bear range due to a steadily growing and expanding Greater Yellowstone bear population during the past 20 years. Grizzly bears have ranged to new areas (including BLM-administered lands) outside of the core population centered in Yellowstone National Park, because protected status has allowed population growth and expansion.

Furbearing Animals

There are no known furbearing special status species in the Planning Area.

Predatory Animals

The gray wolf is a Wyoming BLM sensitive species currently listed as a predatory animal for most of the Planning Area with the exception of that portion of the Cody FO west of Highway 120, where it is classified as trophy game. The USFWS lists the gray wolf as experimental, nonessential. Wolves were reintroduced to the Greater Yellowstone region in winter 1994/1995. Reintroduction has been successful in establishing a wide-ranging population with many packs in northwestern Wyoming. Recovery numbers indicate a recovered population that will be managed by state wildlife agencies as long as the USFWS and the courts accept the Wyoming Wolf Management Plan. Gray wolves were classified as both predators and trophy game animals after the August 2012 delisting from the ESA. The WGFD manages wolves as a trophy game animal along the western side of the Bighorn Basin and as a predator that will be allowed only temporary or limited occupation in conflict-identified areas of the central and eastern Bighorn Basin.

If gray wolves went unmanaged, there would be an upward population trend for years until unoccupied habitat was occupied. This species was managed as an experimental, nonessential endangered species in the Planning Area; however, this designation was removed from this reintroduced population. As of 2012, population and distribution recovery goals for the gray wolf have been exceeded for 10 consecutive years.

Small Game

There are no known small game special status species in the Planning Area.

Game Birds (Greater Sage-Grouse)

Greater sage-grouse populations have declined across North America and the species is a candidate for listing under provisions of the ESA (USFWS 2010). In March 2010, the USFWS published its listing decision for the species as “Warranted but Precluded” and cited inadequacy of regulatory mechanisms as a major threat to the protection of greater sage-grouse populations (USFWS 2010; Manier et al. 2013; BLM 2013a). The USFWS identified conservation measures in RMPs as the BLM’s principal mechanism for protecting greater sage-grouse. BLM’s Wyoming field offices must incorporate objectives and

conservation measures into RMPs in an effort to avoid the potential listing of greater sage-grouse as a threatened or endangered species under the ESA (BLM 2013a).

In 2012, the Director of the USFWS asked the Conservation Objectives Team (COT), consisting of state and USFWS representatives, to produce recommendations regarding the degree to which the threats need to be reduced or ameliorated to conserve greater sage-grouse so that it would no longer be in danger of extinction or likely to become in danger of extinction in the foreseeable future. The COT Report (USFWS 2013a) provides objectives based upon the best scientific and commercial data available at the time of its release. The highest level objective identified in the COT Report is identified as to meet the objectives of the 2006 Western Association of Fish and Wildlife Agencies' (WAFWA) Greater Sage-grouse Comprehensive Strategy (Stiver et al. 2006) of "reversing negative population trends and achieving a neutral or positive population trend." The COT Report provides a Management Zone and Population Risk Assessment and identifies localized threats from sagebrush elimination, fire, conifer encroachment, weed and annual grass invasion, mining, free-roaming equids, and urbanization and widespread threats from energy development, infrastructure, grazing, and recreation.

The North American range of the greater sage-grouse has been divided into seven management zones based on populations within floristic provinces (Stiver et al. 2006). Each floristic province is comprised of areas with similar environmental factors influencing desired plant communities (Knick and Connelly 2011). The Planning Area falls within portions of two greater sage-grouse management zones: the Great Plains Management Zone (MZ I) and the Wyoming Basin Management Zone (MZ II). The majority of the Planning Area lies within MZ II, and the majority of the sage-grouse habitat managed by the BLM in the Planning Area also lies within MZ II. MZ II contains the largest population in the species' range, covers approximately two-thirds of the State of Wyoming, and is separated from adjacent populations by distance and topography (USFWS 2013a). Sage-grouse habitats are expansive and relatively intact outside of areas of energy development. Despite the long-term declines in populations, implementation of the Wyoming Governor's Executive Orders (EOs) for sage-grouse may help alleviate these declines. The primary threats to this portion of the population are energy development and transfer, including both renewable and nonrenewable resources, long-term drought, and brush eradication programs (USFWS 2013a).

The Wyoming basins are one of the remaining strongholds of the sagebrush ecosystem and like most sagebrush habitats, threats to the region are numerous (USFWS 2013a; Hanser et al. 2011). Greater sage-grouse in the Bighorn Basin are recognized as a distinct sub-population (Connelly et al. 2004), but suitable habitat in the Copper Mountain, Owl Creek Mountains, and southern Big Horn Mountains that provide travel corridors enable interchange with other greater sage-grouse populations (Easterly 2012).

Fire is one of the primary factors linked to loss of sagebrush-steppe habitat (USFWS 2013a). Wildfire frequency in some sagebrush ecosystems has also increased due to the incursion of nonnative grasses, resulting in a cycle of more frequent fires that precludes the re-establishment of sagebrush (USFWS 2013a; BLM 2013a). Greater sage-grouse habitat is also threatened by the encroachment of native conifers, notably limber pine (*Pinus flexilis*) and juniper (*Juniperus spp.*), into some sagebrush ecosystems mainly due to changes in fire return intervals and the historic overstocking of domestic livestock (USFWS 2013a). In addition, nonrenewable development activities can significantly reduce, and in some cases locally extirpate, sage-grouse populations, even with the implementation of mitigation measures (USFWS 2013a).

Oil and gas developments and the widespread conversion of nearly 60 percent of greater sage-grouse habitat to agriculture have been the primary sources of decline of greater sage-grouse populations within MZ I (Samson et al. 2004; BLM 2013a). Trends in land cover and land use predominately associated with nonrenewable and renewable energy extraction, along with livestock grazing, prolonged

drought, and programs for brush eradication, have been the primary contributors to population declines in MZ II (Manier et al. 2013; USFWS 2013a; BLM 2013a). Residential development has also been identified as a threat (USFWS 2013a).

Although there is currently little scientific data investigating the effects of livestock grazing practices on greater sage-grouse population levels (Connelly et al. 2004), existing research suggests that grazing may be compatible with, or even beneficial to, greater sage-grouse habitat under certain circumstances. Specifically, light to moderate livestock grazing outside of greater sage-grouse breeding and nesting season has been shown to be generally compatible with the use of these habitats by greater sage-grouse (Crawford et al. 2004), and may result in beneficial impacts through the creation of openings in large sagebrush stands that increase the availability of forbs (Call and Maser 1985; Beck and Mitchell 2000) and by reducing fuel accumulation and fire severity in sagebrush habitat (Peters and Bunting 1994; Davies et al. 2010). In contrast, poor grazing management practices, such as subjecting areas to heavy grazing without rest or rotation, especially during the spring, has been shown to cause degradation of sagebrush ecosystems (DOI and BLM 2002). For more information on the potential impacts of livestock management on greater sage-grouse, see the Literature Synthesis of Livestock Grazing Management Literature Addressing Grazing Management for Greater Sage-Grouse Habitat in the Wyoming Basin – Southern Rocky Mountains Ecoregions (BLM and the National Biological Information Infrastructure Great Basin Information Project no date).

Declines of sage-grouse near oil and gas fields in this area have been well documented (USFWS 2013a). However, recent conservation actions, including the Wyoming Governor's EOs designating protective stipulations for Core Habitat Areas and the implementation of conservation easements within these areas have reduced the threat risk to populations in the Wyoming portion of the Wyoming Basin Management Zone (USFWS 2013a). Designated state Core Habitat Areas adequately capture redundancy and representation for the Wyoming portion of the Wyoming Basin MZ population. Due to the large size of this population, the presence of large, contiguous habitats, and regulatory measures providing habitat protection, this population is considered low risk (USFWS 2013a).

Within the Planning Area, greater sage-grouse are distributed in habitat that has not been rendered unsuitable due to fragmentation and degradation. In spring, males congregate in areas known as leks to engage in competitive courtship displays. There are approximately 252 occupied greater sage-grouse leks in the Planning Area (171 of which are located on BLM-administered lands), generally located at mid-elevation sagebrush habitat. Sage-grouse often return to the same lekking grounds year after year. Nesting and brood-rearing habitat is sometimes associated with the lek and sometimes found at a distance from the lek in sagebrush habitat. These remaining suitable sagebrush habitat areas could be productive for greater sage-grouse; however, fragmentation and degradation sometimes limits the distribution and abundance of greater sage-grouse in these areas.

The Wyoming Game and Fish Department (WGFD) has identified Core Habitat Areas that represent relatively productive areas, and has suggested special management for these areas (Wyoming Office of the Governor 2008). On June 29, 2010, the State of Wyoming issued revised boundaries for its sage-grouse Core Habitat Areas (Version 3) from the previous version (Core Habitat Areas Version 2). As shown on Map 42, the Planning Area contains approximately 1,787,109 acres of Core Habitat Areas (Version 3). Patches of Core Habitat Areas are present throughout most of the Planning Area with the exception of the north-central and east-central portions. Of the 252 occupied leks in the Planning Area, 209 are located in Core Habitat Areas.

The BLM identified Key Habitat Areas for greater sage-grouse, which largely coincide with WGFD Core Habitat Areas, but include additional productive habitats identified as important to greater sage-grouse in the Planning Area by the BLM, such as the Little Mountain Mexican Hills area. Map 40 identifies the

current BLM Key Habitat Areas for greater sage-grouse, which include 1,857,485 acres in the Planning Area. The BLM referenced Core Habitat Areas Version 2 in the delineation of Key Habitat Areas.

The BLM reviewed Core Habitat Areas Version 3 to determine if and how BLM's Key Habitat Areas should be modified for consistency with the revised Core Habitat Area boundaries. Greater sage-grouse priority habitats, as defined in the National Technical Team report (Sage-Grouse NTT 2011) are areas that have the highest conservation value to maintaining or increasing greater sage-grouse populations. These areas include breeding, late brood-rearing, winter concentration areas, and where known, migration corridors. Core Habitat Areas are referred to as "Priority Habitat Management Areas (PHMAs)" hereafter. General greater sage-grouse habitat is occupied (seasonal or year-round) habitat outside of PHMAs and is referred to as "General Habitat Management Areas (GHMAs)" hereafter. These areas have been identified by the BLM in coordination with respective state wildlife agencies and are shown on Map 42a.

Preliminary winter concentration areas have been mapped by WGFD and BLM personnel and will be further refined and delineated as more data are collected (Easterly 2012). There are currently 210,229 acres of greater sage-grouse winter concentration areas mapped in the Planning Area, which are located predominately within PHMAs.

A 2012 report investigating greater sage-grouse populations in the Bighorn Basin identified the following trends (Easterly 2012):

- The number of male sage-grouse observed at leks in the Bighorn Basin declined from 2010 to 2012; however, these declines may be the result of natural fluctuations in sage-grouse population cycles.
- From 2002 to 2011, hunters averaged 0.7 birds per hunter and 2.3 days per hunter. In 2011, individual harvest rates decreased despite an increase in hunter effort in comparison to the 10-year average.
- Greater sage-grouse populations in the Bighorn Basin remain stable and are not in danger of foreseeable extinction, but are currently at a low in the population cycle and are faced with a number of threats.

There are many sources of habitat alteration, all of which may affect greater sage-grouse. Industrial and urban development, livestock and wildlife grazing, mining, gravel pit operations, oil and gas activity, land exchanges and disposal, vegetation manipulation, fuel reduction projects, and other activities may introduce artificial components into a natural habitats. Structures such as powerlines and towers and industrial disruptive activities may cause avoidance and abandonment of habitat. Livestock grazing, fuels treatments, and weed infestations are factors that may cause habitat degradation depending upon severity, intensity, and design. West Nile virus, which recently has had lethal effects on greater sage-grouse in parts of Wyoming, could become an important factor in the long-term survival of the greater sage-grouse species. To date, there has been little research to document the presence of the virus and its effect on greater sage-grouse in the Bighorn Basin. In some circumstances, predators may play a significant role in sage-grouse mortality. Large numbers of raptors migrate to the Bighorn Basin during the winter months, and corvids, which have a propensity for egg predation, appear to be increasing in the Planning Area (BHBLWG 2007). However, actual sage-grouse mortality rates in the Bighorn Basin resulting from predation are currently unknown and are subject to ongoing research (BHBLWG 2007).

Greater sage-grouse have been declining across the western United States, which has prompted several petitions to list them as threatened under the ESA, including a recent petition that led to the March 2010 finding by the USFWS of warranted for listing but precluded (USFWS 2010). Population levels

throughout the Planning Area declined during the mid-1990s. However, population levels have remained stable or slightly increased since 2004. Well-timed precipitation events are suspected as a major factor in this resurgence (WGFD 2000; WGFD 2004). These precipitation events promoted forage growth, which aided the survival of young. Population growth has varied throughout the Planning Area based on specific local conditions, with some areas showing little change; other areas have had a recent increase in lek count numbers. With more favorable spring and summer conditions for greater sage-grouse in many parts of the Bighorn Basin in recent years, there are some greater sage-grouse leks that have become active again after many years of non-use. Even so, population modeling suggests that declines will continue over the long-term (USFWS 2013a). Winter conditions generally are not a limiting factor in the Bighorn Basin because snow depths are not as severe as in other parts of Wyoming.

Wyoming Governor's Executive Order 2011-5 sets forth a collaborative strategy for the protection of Core Areas (PHMAs) between state and federal agencies, local governments, and private landowners (Wyoming Office of the Governor 2011). This guidance is supplemented by Executive Order 2013-3, which requires that the BLM collaborate with appropriate federal agencies and the State of Wyoming to: 1) develop appropriate conservation objectives; 2) define a framework for evaluating situations where Greater Sage-Grouse conservation objectives are not being achieved on federal land, to determine if a causal relationship exists between improper grazing (by wildlife or wild horses or livestock) and Greater Sage-Grouse conservation objectives; and 3) identify appropriate site-based action to achieve Greater Sage-Grouse conservation objectives within the framework (Wyoming Office of the Governor 2013).

Migratory Game Birds (Waterfowl)

There are no known migratory game bird special status species in the Planning Area.

Nongame Birds (Raptors)

There are five nongame special status raptor species in the Planning Area – bald eagle, burrowing owl, ferruginous hawk, northern goshawk, and peregrine falcon – all BLM sensitive species. Raptor populations in the Planning Area are generally increasing due to current protection measures. Map 39 shows the locations of special status raptor species nests in the Planning Area.

Management challenges for special status raptor species include habitat degradation and fragmentation, collision and electrocution from powerlines, and incompatible land use practices (e.g., land conversion, clear-cutting, snag removal, industrial activities, intensive recreational activities, and removal of burrowing mammals). Other challenges include impacts from contaminants and human disturbance during sensitive periods.

Bald Eagle

The Bighorn Basin, because of climate and food sources, is predominantly a wintering area for bald eagles, with as many as 200 to 300 observed during the mid-winter eagle count. Bald eagles nest in trees near large bodies of water such as lakes, reservoirs, and large rivers. Bald eagles feed mainly on fish, although they will also consume waterfowl and carrion. Bald eagles are being observed more frequently moving through the Planning Area, and as indicated by mid-winter surveys, it is assumed their population numbers are continuing upward. New nesting sites have been reestablished along larger river systems in the Bighorn Basin over the last 20 years. There are approximately 14 known bald eagle nests in the Planning Area.

Burrowing Owl

The burrowing owl is a mid-sized owl closely associated with prairie dog colonies. Burrowing owls nest in abandoned prairie dog burrows and feed on prairie dogs and other rodents.

Ferruginous Hawk

Ferruginous hawks usually nest on rock outcrops, promontories, tall sagebrush, or in junipers where numerous small mammals provide abundant prey base. Ferruginous hawks are not common in the Bighorn Basin. Many previously active ferruginous hawk nest sites are inactive, so populations might be declining.

Northern Goshawk

Northern goshawks occur in coniferous and deciduous forests (BLM 2010b). Due to dense canopy cover in these areas, nests are difficult to find and inventories for these species are limited to areas identified for habitat alterations.

Peregrine Falcon

Peregrine falcons usually build their nests on steep cliffs and rock ledges. Peregrine falcons are now established in several areas of the Bighorn Basin as a result of reintroduction efforts.

Nongame Birds (Migratory Birds)

There are ten BLM sensitive migratory birds in the Planning Area – Baird's sparrow, Brewer's sparrow, loggerhead shrike, long-billed curlew, yellow-billed cuckoo, sage sparrow, sage thrasher, trumpeter swan, white-faced ibis, and mountain plover. These species occur throughout a variety of habitats in the Planning Area (see Table 3-34). The BLM has little abundance or occurrence data for these species.

Management challenges for migratory birds include habitat fragmentation and degradation, land conversion, incompatible land uses (e.g., industrial activities, human disturbance, contaminants, and agricultural practices), water quantity and quality, collision with powerlines, and interspecific competition for nest sites.

The sage thrasher, loggerhead shrike, Baird's sparrow, Brewer's sparrow, sage sparrow, and long-billed curlew depend somewhat on sagebrush and some are considered sagebrush obligates. Threats to this habitat type include fragmentation and degradation. Sagebrush habitats in the Planning Area are important breeding areas for these migratory species (Birds of North America Online 2008). These migratory birds occupy habitats that are at risk or in decline; therefore, populations might be declining.

Baird's Sparrow

This species occupies grasslands and nests in depressions. The Baird's sparrow forages on insects or seeds.

Brewer's Sparrow

The Brewer's sparrow is a sagebrush obligate bird that requires intact sagebrush habitats for almost all its nesting and foraging needs.

Loggerhead Shrike

Shrublands are the preferred habitats for the loggerhead shrike. This species typically nests in deciduous trees or tall shrubs and feeds on insects, small vertebrates, and carrion.

Long-Billed Curlew

The long-billed curlew is an upland shorebird occupying grasslands and wet meadows. Typical nest sites are on the ground near water with a supply of insects and aquatic macroinvertebrates.

Mountain Plover

The mountain plover inhabits shortgrass prairies and shrub-steppe habitats, both for breeding and wintering. This species prefers areas with little vegetative cover for nesting, particularly prairie dog towns. In the Bighorn Basin, there is an abundance of naturally sparse habitats for mountain plover nesting.

Sage Sparrow

The sage sparrow is a sagebrush obligate bird that requires intact sagebrush habitats for almost all its nesting and foraging needs.

Sage Thrasher

Similar to the sage sparrow, the sage thrasher is a sagebrush obligate bird that requires intact sagebrush habitats for almost all its nesting and foraging needs.

Trumpeter Swan

The trumpeter swan can occupy still-water areas such as lakes, ponds, and marshes, and can use these areas for nesting or migration. The trumpeter swan population might be increasing in the Planning Area. This riparian associated species and its habitat are threatened by invasive species such as Tamarisk, Russian olive, and knapweed, which degrade its habitat. Pesticide use and collision with anthropogenic features also cause direct mortality and reduce habitat suitability.

White-faced Ibis

The white-faced ibis can occupy still-water areas such as lakes, ponds, and marshes, and can use these areas for nesting or migration. The white-faced ibis population might be increasing due to breeding-range expansion in the last 2 decades, due in part to improved nesting habitat management in federal and state refuges (Birds of North America Online 2008). Similar to other riparian-associated species and their habitats, the white-faced ibis is threatened by invasive species such as Tamarisk, Russian olive, and knapweed, which degrade its habitat. Pesticide use and collision with anthropogenic features also cause direct mortality and reduce habitat suitability.

Yellow-billed Cuckoo

The yellow-billed cuckoo can occupy still-water areas such as lakes, ponds, and marshes, and can use these areas for nesting or migration. Yellow-billed cuckoo can occupy the river corridors and any associated riparian areas nearby. They have been shown to prefer open cottonwood galleries with a low-profile shrub component. The yellow-billed cuckoo is on the decline throughout its range. The yellow-billed cuckoo and its habitat are threatened by invasive species, pesticide use, and the threats other riparian associated species face.

Nongame Mammals

Nine nongame special status mammal species occur in the Planning Area – black-footed ferret (endangered), Canada lynx (threatened), North American wolverine (proposed), Townsend's big-eared bat (BLM sensitive), long-eared myotis (BLM sensitive), spotted bat (BLM sensitive), white-tailed prairie

dog (BLM sensitive), and black-tailed prairie dog (BLM sensitive). Management challenges for special status mammals include habitat fragmentation and degradation, land conversion, incompatible land uses (e.g., industrial activities, human disturbance, use of contaminants, abandoned mine lands [AMLs] and cave closures, and animal damage-control practices), lack of cottonwood and willow regeneration, collision with wind turbines (bats), and snag removal in preferred habitats. Management actions are intended to maintain and enhance the presence of nongame mammals and the habitats upon which they depend.

Black-footed Ferret

Thought to be extinct for many years, the black-footed ferret was rediscovered in 1981 northwest of Meeteetse in a large white-tailed prairie dog colony in the Planning Area. The species was taken into captivity and is now successfully being bred, raised, and reintroduced into historical habitats. The black-footed ferret has not been documented elsewhere in the Planning Area or any other locations since its rediscovery. Loss of habitat is the primary reason black-footed ferrets remain listed as endangered. Conversion of grasslands to agricultural uses, widespread prairie dog eradication programs, and incidences of the plague have reduced ferret habitat to less than 2 percent of its historic range. Remaining habitat is now fragmented, with prairie dog towns separated by great expanses of cropland and human development. Since the black-footed ferret was found, researched in the mid-1980s, and subsequently removed for species preservation at breeding facilities, there have been no known and confirmed occurrences in the Planning Area.

Canada Lynx

Canada lynx generally occur in dense coniferous forests at high elevations. Canada lynx have not been documented on BLM-administered land in the Planning Area; however, there are four Lynx Analysis Units that encompass BLM-administered lands and adjacent larger tracts of USFS-managed land along the western and northeastern boundaries of the Planning Area. Lynx habitat does overlap BLM-administered lands. Lynx population information is difficult to obtain due to their reclusive nature. It might be possible that lynx occupy suitable habitat on BLM-administered lands but are not observed. Canada lynx critical habitat has been identified in Wyoming; however, there is no critical habitat designated in the Planning Area, and there have been no confirmed or known occurrences on BLM-administered land. There is no known population trend.

North American Wolverine

In February 2013, the USFWS proposed to list wolverine as threatened under the ESA. Wolverine occurrence in the Planning Area is unknown, but the species could be found in boreal forest and/or alpine habitats along the western edge of the basin where there are limited areas of BLM-administered lands with elevations above 9,500 feet in the Absaroka and Owl Creek mountain ranges. In North America, wolverines occur within a wide variety of habitats, primarily boreal forests, tundra, and western mountains throughout Alaska, Canada, and south to the contiguous United States. Currently, wolverines are found in the North Cascades in Washington and the northern Rocky Mountains in Idaho, Montana, Oregon (Wallowa Range), and Wyoming. Wolverines are opportunistic feeders and consume a variety of foods depending on availability. They primarily scavenge carrion, but also prey on small animals and birds, and eat fruits, berries, and insects. Wolverines have an excellent sense of smell that enables them to find food beneath deep snow.

Bat Species

There are three BLM sensitive bat species in the Planning Area – Townsend's big-eared bat, long-eared myotis, and spotted bat. These bat species are associated with riparian, upland range, forested, and

karst habitat and are susceptible to disturbance and degradation of these habitats. Maternity, hibernacula, and day-roost sites are important to these species and could be disturbed by recreation activities associated with caving. Sometimes these disturbances can cause habitats to become unsuitable for critical life history requirements. There is little population data for bat species, so a trend cannot be determined.

White-tailed Prairie Dog

The white-tailed prairie dog is associated with desert grasslands and shrub grasslands. A long-term study of white-tailed prairie dogs in the Planning Area indicated that there has been a decline in abundance and distribution of this species.

Black-tailed Prairie Dog

There is one known black-tailed prairie dog colony in the Planning Area, which is typically associated with the short grass prairie north and east of the Bighorn Basin.

Nongame Amphibians

Special status amphibians in the Planning Area include the boreal toad, Columbia spotted frog, northern leopard frog, and Great Basin spadefoot toad, all of which are BLM sensitive species. These species are associated with riparian/wetland, woodland, and forested habitat and are susceptible to disturbance from habit degradation and fragmentation, pollution, modified hydrology, and other factors related to the current global decline in amphibian populations.

Management challenges for amphibian species include habitat degradation, land conversion, incompatible land uses (e.g., contaminants and conversion or degradation of aquatic habitats) and degradation of water quantity and quality. Amphibian populations in the Planning Area are thought to be declining because of these issues and other factors related to the general global decline in amphibians.

3.4.10 Wild Horses

The BLM is responsible for protecting, managing, and controlling wild horses on public lands in the Planning Area. The BLM collects data about the animals and their habitat and prescribes management actions to ensure that free-roaming populations are in balance with other uses. In addition, the BLM ensures that the productive capability of wild-horse habitat and a thriving natural ecological balance is achieved and maintained. Wild horses are of interest to some members of the public and are classified as a resource value rather than a land use.

Existing wild horse herds originated from animals released during early European-American exploration and settlement in the region in the 1800s. Current populations incorporate genetic traits from a wide variety of breeds historically used in the region.

The BLM manages wild horses in the Planning Area in two Wild Horse Herd Management Areas (HMA) (Map 45) – the McCullough Peaks HMA and the Fifteenmile HMA. Each HMA has a Herd Management Area Plan that establishes appropriate management levels. Each HMA is located within the boundaries of a larger Herd Area of the same name (Table 3-35); portions of these Herd Areas outside of the HMA boundaries are not managed for wild horses. In addition, there are five Herd Areas in the Planning Area that are not currently managed for wild horses but remain Herd Areas in perpetuity. Analysis for previous decisions determined that managing wild horses in these Herd Areas resulted in management

issues or conflicts (e.g., competition with livestock for water sources or forage, and adjacent landowner complaints), that were most appropriately resolved by the removal of wild horses. Previous decisions also determined that management of wild horses within the original Herd Area boundaries would result in issues or conflicts. Table 3-35 lists acreages and appropriate management levels for the two HMAs and seven Herd Areas, as well as the reason horses were removed from the Herd Areas not managed for wild horses and the decision document or other documentation related to these removals. The wild horse population in 2009 in the HMAs was 199 (see Table 3-35). The BLM collects annual monitoring data to evaluate progress toward meeting management objectives.

Table 3-35. Wild Horse Herd Management and Herd Areas

Herd Management Areas and Herd Areas	BLM-Administered Land (acres)	BOR, State, and Private Land (acres)	Appropriate Management Level (total head)	Estimated Number of Horses (2009)	Herd Area Horse Closure Decision Document and Date	Reason for Herd Area Horse Closure
McCullough Peaks Herd Management Area	103,866	5,999	70-140	110	N/A	N/A
McCullough Peaks Herd Area	138,580	39,283	N/A	Likely same as McCullough Peaks HMA, but not monitored.	N/A	N/A
Fifteenmile Herd Management Area	70,527	10,583	70-160	89	N/A	N/A
Fifteenmile Herd Area	221,018	40,850	N/A	N/A	N/A	N/A
Foster Gulch Herd Area	134,219	7,081	0	0	Environmental Analysis, McCullough Peaks Wild Horse Management Plan. (BLM 1985)	Better control and management; resource conflicts with trespass branded horses (i.e., unfenced boundaries) had occurred; water not owned or controlled by BLM and/or not available within the Herd Area.

Table 3-35. Wild Horse Herd Management Areas and Herd Areas (Continued)

Herd Management Areas and Herd Areas	BLM-Administered Land (acres)	BOR, State, and Private Land (acres)	Appropriate Management Level (total head)	Estimated Number of Horses (2009)	Herd Area Horse Closure Decision Document and Date	Reason for Herd Area Horse Closure
North Shoshone Herd Area	19,231	3,395g.	0	0	Environmental Analysis Record, Horse Roundup-North Shoshone Area (BLM 1976); wild horse count reported absent in 1980. (BLM 1980)	Unauthorized horses, potentially claimed/ removed by a local individual. Horses removed by unknown means. (BLM 1980)
Zimmerman Springs Herd Area	11,518	759	0	0	Washakie Resource Management Plan. (BLM 1988a)	Competition for forage with livestock; water not owned or controlled by BLM and/or not available within the Herd Area.
Alkali Spring Creek Herd Area	2,600	2,583	0	0	Environmental Analysis, Spring Creek Wild Horse Removal. (BLM 1981)	Private landowner requests.
Sand Draw Herd Area	13,743	1,559	0	0	Grass Creek Grazing Environmental Impact Statement. (BLM 1983b)	Competition for forage and water with livestock.

Sources: BLM 2013a; BLM 2009a; BLM 2009k; BLM 1990; BLM 1988a; BLM 1983b; BLM 1981; BLM 1976.

BLM Bureau of Land Management
BOR Bureau of Reclamation
N/A Not Applicable

The wild horse program receives a high level of public interest and scrutiny. For a variety of purposes and reasons, multiple public organizations closely monitor the health, nutrition, and general well-being of wild horse herds. These groups present unique opportunities for cooperative and collaborative partnerships, and for controversy. Such groups in the Planning Area have provided monitoring assistance and publicity for the wild horse program.

The Pryor Mountain Horse Range is physically located in the northern portion of the Planning Area and in Montana and is administered by the Billings BLM Field Office. This RMP revision project does not address the Pryor Mountain Area.

McCullough Peaks HMA

Before the passage of the Wild Free-Roaming Horses and Burros Act of 1971, wild horses were already prominent in the area from what were known as U.S. Cavalry remounts, which included Clydesdale stock, Percheron and Thoroughbred crosses, and most notably, the Cleveland Bay breed. This resulted in the present-day configuration and distribution of wild horses in the McCullough Peaks HMA. The historic water sources at various springs, Shoshone River, and Dry Creek, along with the development of water sources in the 1950s through 1970s, influenced the horses' selection of this area as its home range.

Existing boundary and division fences associated with management of the allotments did not affect horse movement in the late 1980s and 1990s. However, with the increase in public presence in the 2000s, fences have increasingly prevented horse movement and have created a physical barrier that is sometimes harmful to the horses.

Since 1990, much of the exterior boundary of the approximately 110,000-acre HMA has been fenced. An interior fence was also constructed, forming pasture and allotment boundaries to improve management of livestock grazing. The combination of the exterior and interior fences has limited the mobility of the wild horses. Increases in other human activities in the Red Point area, primarily recreational viewing and Special Recreation Permit (SRP) viewing, have resulted in keeping 80 percent of the herd within 20 percent of the HMA.

Horse management planning documents call for the HMA to support 70 to 140 total head of wild horses (1,050 to 2,100 animal unit months [AUMs]) in an attempt to maintain an average of 100 adult wild horses in the HMA (1,500 AUMs). An AUM is the amount of forage necessary for the sustenance of one cow or its equivalent for a period of 1 month; however, as determined in the 1985 McCullough Peaks Wild Horse Herd Area Management Plan (BLM 1985) and the NRCS National Range and Pasture Handbook (NRCS 2003) the BLM bases its appropriate management level calculations on 1.25 AUMs per horse per month. Once herd levels surpass 140 head, or after approximately 4 years, the BLM gathers and removes enough horses to leave 70 head, for an overall average of 100 adult horses. This method is more cost-efficient than annual roundups and has resulted in less capture-induced stress on the horses. There were gathers in 1983 (215 removed), 1987 (152 removed), 1992 (225 removed), 1995 (170 removed), 1999 (188 removed), 2004 (362 removed), 2009 (94 removed), and 2013 (27 removed).

The McCullough Peaks HMA is approximately 12 miles east of Cody, extending an additional 15 miles east, with U.S. Highway 14-16-20 forming the southern boundary. It is bounded on the north by BOR-withdrawn lands controlled by the Willwood Irrigation District. McCullough Peaks and State Highway 32 comprise the western and eastern boundaries. The HMA encompasses approximately 109,856 acres, of which 103,866 acres are on BLM-administered land; the remaining 5,993 acres is scattered parcels of state and private lands. In the third quarter of 2009, the herd had approximately 110 horses.

Vegetation in the McCullough Peaks HMA consists primarily of salt desert shrub and Wyoming big sagebrush communities (BLM 2009a). Big sagebrush, Nuttalls saltbush, greasewood, bluebunch wheatgrass, western wheatgrass, needle-n-thread, Indian ricegrass, blue grama, Sandberg bluegrass, and saltgrass are the major plant species in the area. Average annual precipitation is approximately 5 to 7 inches, with 40 percent occurring from April through June.

There are five grazing allotments in the HMA, and livestock use within these allotments is authorized during spring, summer, fall, and winter depending on the specific allotment and its specified rotational grazing strategy. Each allotment has a built-in rest period during the growing season at least once every 3 years. Water development benefits wild horses, livestock, and wildlife.

At present, the wild horses in the McCullough Peaks HMA are considered to be in good health. Most horses are of ample body condition and forage conditions range from poor to good, with some areas considered in excellent condition. However, the drought of the late 1990s through 2008 adversely affected rangeland health.

Approximately 12,445 acres of the McCullough Peaks HMA is classified as a WSA and is managed in accordance with BLM Manual 6330 (BLM 2012a). Horses are regularly observed in the WSA, and their use is considered compatible with the management objectives and values associated with the WSA.

McCullough Peaks HMA is popular among visitors for its easily photographed horses, easy access, and year-round availability. The BLM issues SRPs for wild horse viewing activity twice daily from May through October. The SRP has a cap of 2,000 visitor-use days with one primary active SRP holder. There has been continued interest from additional "outfitters" or guide services to obtain additional visitor-use days for viewing wild horses. These 2,000 visitor-use days do not include the general public in the calculation. Over the last 8 years, more and more members of the general public have viewed wild horses. However, because of frequent exposure to people, more than 80 percent of the horses have become approachable and do not display the wild and unique characteristics for which they were once known.

Fifteenmile HMA

Wild and free roaming horses have been reported in the Fifteenmile area since the late 1880s. Historically, the horse herd ranged over approximately 330,000 acres between Worland and Meeteetse, and the Greybull River and Gooseberry Creek. After the ranching community arrived, it was common practice to cull the horses periodically and to occasionally introduce new horses to the population. The horses were then gathered as needed. In the 1930s and 1940s, many horses were shot and others were captured and sold. In the 1950s, almost all the horses (approximately 600) were captured and sold. Some wild horses were periodically gathered by local residents until the practice was prohibited in 1971 by the passage of the Wild Free-Roaming Horses and Burros Act.

The wild horse population in 1971 was estimated to be between 150 and 175 head. The first intensive inventory of the population took place in 1974, when 245 horses were counted. In 1978, wild horse numbers had increased to approximately 334 head, and due to drought conditions, the BLM removed 186. The BLM removed another 360 horses in 1984. The Fifteenmile Wild Horse Herd Management Area Plan was approved in 1985. This plan established the current HMA boundary, and specified that the wild horse herd would be managed within a range of 70 to 160 mature horses. The plan also specified that following gathers, the horses remaining on the range would be managed in a ratio of 60 males to 40 females to help slow population growth. Since 1985, there have been periodic (every 4 to 6 years) gathers to reduce the population. These gathers occurred in 1991 (129 horses removed), 1994 (141 horses removed), 2000 (161 horses removed), 2004 (115 horses removed), and 2009 (301 removed).

The Fifteenmile Wild Horse HMA is approximately 35 miles northwest of Worland. The HMA encompasses approximately 81,107 acres, with portions in Big Horn, Park, and Washakie counties, of which approximately 10,383 acres, or about 13 percent, are privately owned. The HMA can support a wild horse population of 70 to 160 mature horses over 1 year of age, or 100 to 240 total horses. However, rangelands in the HMA cannot sustain both the wild horse population and the full permitted livestock grazing use level. In the third quarter of 2009, the herd had approximately 89 horses.

Rangelands in the Fifteenmile HMA are in conformance with the *Wyoming Standards for Healthy Rangelands* (Appendix N). Annual precipitation in the Fifteenmile HMA ranges from 4 to 12 inches per

year, with an average of approximately 7 inches per year. About half of the precipitation falls during the growing season from April through June, with the remainder falling in high intensity summer thunderstorms. Much of the precipitation occurs during summer thunderstorms as runoff to numerous drainages. Some of this water is captured in reservoirs or pits and is the primary source of water for wild horses, livestock, and wildlife. Due to the erosive nature of the soils, these reservoirs and pits quickly fill with sediment, thereby reducing their capacity to hold water. Evaporation rates are high due to the hot, dry weather during summer. In some parts of the HMA that receive little wild horse use, vegetative cover and litter have increased to the point that storm runoff is not sufficient to fill some reservoirs and pits. Because of these factors, water availability is a concern in the HMA.

There are five unfenced livestock grazing allotments in the HMA, and the total permitted livestock grazing on these allotments is 7,925 AUMs, based on the original forage adjudication. An AUM is the amount of forage necessary for the sustenance of one cow or its equivalent for a period of one month. This use is limited to winter sheep use from November through March. Most of this permitted grazing use has been in voluntary non-use for several years, largely because permittees do not run sheep, but permittees could activate grazing use at any time. The overall recommended stocking level for both livestock and wild horses in the HMA, based on rangeland vegetation inventory and suitability data, is approximately 5,670 AUMs. The Grass Creek RMP allocated a total of 2,300 AUMs of forage for wild horses, which is the amount of forage required to sustain the wild horse population at the upper range of the appropriate management level, and 3,370 AUMs of forage for domestic livestock.

The wild horses in and around the HMA are considered to be healthy and in good physical condition. Genetic testing has indicated that the herd exhibits a high degree of genetic variability. Some of the horses frequently travel outside the HMA onto adjacent livestock grazing allotments. There is a small band of horses outside the HMA, approximately 10 to 20 wild horses, in the Fivemile Creek area. There is no known interaction between these horses and the horses in the Fifteenmile HMA. Over the last 20 years, the BLM has attempted several times to remove these horses, but due largely to the remoteness of the area and rugged topography, a few horses have always evaded capture.

Management Challenges

Management challenges for wild horses include controlling herd populations to maintain herd and rangeland health and habitat, forage, and water for native wildlife. Since 1973, when the horse and burro adoption program began, the two legal means of disposing of surplus, gathered animals has been through public adoptions and euthanasia. Some animals, especially older studs, lack the physical appeal and disposition that attract adopters. Ultimately, when these animals are perceived as unadoptable, they are returned to holding facilities or released back onto public lands. Euthanasia is currently the subject of heated public debate. The BLM no longer euthanizes horses to control populations, and the BLM has no current plans to resume the practice in the Planning Area.

From 1988 to 2004 congressional appropriations did not allow public funds for euthanasia as a method of population control. In the fall of 2004, Congress amended the Wild Free-Roaming Horses and Burros Act of 1971 to facilitate the sale of animals 10 years of age and those that have been offered unsuccessfully for adoption at least three times. In fiscal year 2010, congressional appropriations once again did not allow for public funds for euthanasia for population control.

McCullough Peaks Herd Management Area

Although monitoring data indicate horses have localized impacts on vegetation in areas near water in relation to drought, current management of the horse herd should not affect these plant communities. There could be impacts to rangeland resources if herd numbers are allowed to grow beyond appropriate management levels. Continuing to implement fertility control during gathers will help maintain and improve rangeland resources. Managing horse distribution and grazing use will impact the long-term success of a healthy watershed and healthy horses.

With the administration of fertility control methods, the horse population is expected to increase at a rate of 15 percent annually, slower than in the past (BLM 2008a). In 2004, 36 mares were treated with a revised immune-contraceptive vaccine. A single injection will provide up to 2 years of contraception at approximately 94 percent efficiency (BLM 2009l). Contraceptives will become a more common tool in limiting the growth of the horse herd. Scheduled, periodic small gathers will continue so as to maintain population numbers in the targeted range of the appropriate management level.

Fifteenmile Herd Management Area

At present, the wild horses in the Fifteenmile HMA are considered to be in good health. Most horses are of ample body condition and forage conditions range from poor to good, with some areas considered in excellent condition. However, the long-term drought has adversely affected rangeland health. There could be impacts to rangeland resources if herd numbers are allowed to grow beyond appropriate management levels. Managing horse distribution and grazing use will impact the long-term success of maintaining healthy watersheds and wild horse populations.

3.5 Heritage and Visual Resources

This section includes the individual resources of cultural, paleontological, and visual resources. The following sections describe the resource, its existing condition, and management challenges. Section 3.7.3 *National Historic Landmarks* describes the Heart Mountain Relocation Center and Section 3.7.4 *National Historic Trails and Other Historic Trails* describes historic trails in the Planning Area.

3.5.1 Cultural Resources

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. Cultural resources include archeological resources, historic architectural and engineering resources, and traditional resources. Archeological resources are areas where prehistoric or historic activity measurably altered the earth or where deposits of physical remains (e.g., projectile points, pottery, or bottles) are discovered. Architectural and engineering resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic value. Traditional resources can include archeological resources, structures, topographic features, habitats, plants, wildlife, and minerals that Native Americans or other groups consider essential for the preservation of traditional culture.

3.5.1.1 Identified Cultural Resources

History of Cultural Resource Investigations in the Planning Area

Site identification and recording in the Planning Area dates to the mid-20th Century, when, in 1946, the Smithsonian Institution sponsored work as part of the River Basin Surveys for projects such as Anchor Reservoir in the Absaroka Mountain Slope and Owl Creek subregions and the Oregon Basin Reservoir in the Bighorn Basin subregion. Since the early 1970s, there have been extensive modern cultural resources investigations in the Planning Area. Most investigations have been accomplished in compliance with Section 106 of the National Historic Preservation Act (NHPA) and provisions of National Environmental Policy Act (NEPA), both of which require federal agencies to consider the potential effects of federally assisted or permitted projects on important cultural resources. The BLM has performed cultural resources investigations in the Planning Area pursuant to the BLM stewardship responsibilities under NHPA Section 110, which requires federal land management agencies to identify and preserve important cultural resources on lands those agencies administer.

Cultural Subregions in the Planning Area

There appears to be a pattern of human use of the landscape that changes based on vegetation and other resource availability. The use of areas with less than 10 inches of annual precipitation appears to vary from the use of areas with more precipitation. Identified cultural subregions in the Planning Area include:

- *North Slope of the Bridger Mountains*: Areas with vegetation patterns that indicate average annual precipitation of more than 10 inches along the northern margin of the Bridger Mountains.
- *North Slope Owl Creek Mountains*: Areas with vegetation patterns that indicate average annual precipitation of more than 10 inches along the northern margin of the Owl Creek Mountains.
- *West Slope of the Big Horn Mountains*: Areas with vegetation patterns that indicate average annual precipitation of more than 10 inches along the eastern margin of the Bighorn Basin.

- *East Slope of the Absaroka Mountains*: Areas with vegetation patterns that indicate average annual precipitation of more than 10 inches along the western margin of the Bighorn Basin.
- *Bighorn Basin*: Areas with vegetation patterns that indicate average annual precipitation of less than 10 inches.
- *Clarks Fork Basin*: Areas within the Clarks Fork of the Yellowstone River drainage, which are included in the Yellowstone watershed, with vegetation patterns that indicate average precipitation of less than 10 inches. These areas are differentiated from the Bighorn Basin and surrounding East Slope of the Absaroka Mountains subregions.

Number of Cultural Resource Sites Recorded in the Planning Area

Cultural resources investigations in the Planning Area have recorded approximately 8,340 prehistoric and historic cultural resources (Table 3-36).

Table 3-36. Cultural Resources Inventories, Sites, and Site Density in the Planning Area

Subregion	Number of Surveys	Total Area Surveyed (acres)[1]	Recorded Prehistoric Sites	Per Acre Occurrence of Prehistoric Sites	Recorded Historic Sites	Per Acre Occurrence of Historic Sites[2]	All Recorded Sites	Per Acre Occurrence of All Sites	Overall Site Density[3]
North Slope of the Bridger Mountains	317	8,989	116	0.013	38	0.004	154	0.017	1 site in 58 acres
North Slope Owl Creek Mountains	259	2,646	52	0.02	73	0.028	125	0.047	1 site in 21 acres
West Slope of the Big Horn Mountains	960	43,401	509	0.012	58	0.001	567	0.013	1 site in 77 acres
East Slope of the Absaroka Mountains	1,509	66,375	381	0.006	186	0.003	567	0.009	1 site in 117 acres
Bighorn Basin	2,776	252,161	5,470	0.022	1,335	0.005	6,805	0.027	1 site in 37 acres
Clarks Fork Basin	259	3,262	96	0.029	26	0.008	122	0.037	1 site in 27 acres
Planning Area Totals[4]	**6,080**	**376,834**	**6,624**	**0.018**	**1,716**	**0.005**	**8,340**	**0.0222**	**1 site in 45 acres**

Source: Wyoming SHPO 2009

[1]May include some areas that have been resurveyed.
[2]Total corrected for sites that have both historic and prehistoric components.
[3]Rounded to nearest acre.
[4]Wyoming Cultural Records Office database information current as of January 2009.

Types of Cultural Resources Recorded in the Planning Area

Prehistoric cultural resources are materials deposited or left behind prior to the entry of non-American Indian (European) explorers and settlers into an area. Protohistoric refers to the variable transition period from prehistoric to historic. The latter is the time after Europeans established a presence. The Prehistoric Period, subdivided into a number of subperiods (e.g., Paleoindian Period, Archaic Period, Late Prehistoric Period), began with the entry of human beings into North America sometime about 12,000 to 15,000 years ago, or perhaps much earlier, according to recent data (BLM 2009a). The Protohistoric Period in northwestern Wyoming was initiated in the early 19th Century with the entry of fur trappers and explorers, although early French and British trappers might have passed through the general area in the early to mid-18th Century (BLM 2009a). The establishment of trading centers at Fort William (present-day Fort Laramie) and other trading forts on the Yellowstone and upper Missouri rivers in the early 1830s ushered in the Historic Period, because these were the first permanent European settlements in the region.

Most recorded prehistoric sites in the Planning Area consist of lithic scatters, campsites or habitations of various kinds, stone circles, and stone cairns. Other prehistoric site types include burials, ceremonial stone alignments, rock art, rock shelters, ceramic sites, quarries and secondary lithic procurement sites, hunting blinds, structures, and bison kill and butchering sites. Recorded historic cultural resources in the Planning Area include trails, freight wagon and stagecoach trails, an historic highway, early ranches and farms, stockherding camps, irrigation systems, mines, early oil fields and associated camps, railroads, bridges, and urban buildings. Some locations are noted, but not formally recorded, including utility lines, pipelines, stock dams, survey markers, carbanks or abandoned vehicles and appliances, rip-rap, fencing, recent trash, well and hole markers, culverts, bear baiting sites, unnamed two-track roads, and small-capacity irrigation canals with no historic association.

Native American Site Types in the Planning Area

Native American prehistoric sites are listed in the Wyoming Cultural Records Office (WYCRO) database under 198 site types or characteristics. These can be grouped into 15 generalized or composite site types that are the most commonly occurring types in the Planning Area and the surrounding region, as follows:

- Burials – physical human remains, deliberately interred or not.
- Cairns – piles of stones deposited by prehistoric people for a variety of reasons and purposes, including stockpiling of lithic source materials, marking burials or other ceremonial events, or as locational markers for trails, water sources, or other resources.
- Campsites – locations that contain evidence of at least short-term occupation by prehistoric people.
- Ceramic sites – sites of any other type that contain prehistoric pottery.
- Lodge sites/prehistoric structures/house pits – habitations or occupations that can include features such as stone and wood elements.
- Hunting blinds or traps – structures built by prehistoric people to aid in hunting of big game such as bison, pronghorn, and possibly birds, and that these people might have used for ceremonial purposes.
- Kill sites or butchering/processing sites – locations that contain extensive bone or other evidence of the killing and processing of big game by prehistoric, protohistoric, or early historic aboriginal people.

- Lithic scatters – assemblages of flakes, tested or worked stone cores, roughly shaped pre-forms for tools, and sometimes finished tools that are the products of reduction of stone material into useable tools.
- Quarries – primary procurement sources for lithic materials used by prehistoric people.
- Rock art – includes pictographs or petroglyphs on rock faces or individual rocks.
- Rock shelters or caves – naturally occurring recesses or overhangs that afforded prehistoric people protection from the elements.
- Secondary lithic procurement sites – locations where glacial or stream actions have deposited lithic materials or where lithic materials have otherwise eroded from primary geological contexts.
- Stone alignments and effigies – usually interpreted to be associated with ceremonial or spiritual activities, but some alignments could have been associated with big game hunting or possibly have been locational landmarks.
- Stone circles – rings of rocks that might represent former locations of tipis or other structures, or might represent prehistoric ceremonial activities.
- Other unknown – sites that have limited or no data that can be properly categorized. This category contains a small percentage (about 1 percent) of the recorded sites in the entire Planning Area.

Historic Era Resources in the Planning Area

Historic period resource types are also categorized according to descriptive types. Certain broad categories are commonly used, particularly for emigrant trails and expansion era roads. Most of the 123 site type or characteristic categories in the WYCRO database for the Planning Area can be grouped into 11 thematic or site type groups, as follows:

- Burials and cemeteries – in the historic context, deliberately established burials, interments, and burial groupings such as cemeteries.
- Historic debris – refuse scatters that cannot be directly associated with another category.
- Homesteads/ranches – residences and outbuildings, fields and facilities associated with operation of a farm or ranch or, on occasion, with recreation or the tourism industry.
- Irrigation-related sites – ditches, canals, pumps, or other debris or features directly related to irrigation projects.
- Military sites – forts, camps, and battlefields, and transportation or communications features that can be directly related to military activities.
- Mineral exploration and extraction – oil, gas, coal, and other mining location and associated features.
- Stockherding – typically camps that are not principal ranches or farm headquarters and cairns that cannot be ascribed to some prehistoric or aboriginal activity.
- Timber sites – typically service roads and structures associated with the timber industry. Specific buildings include sawmills.
- Transportation/communications sites – trails, expansion era stagecoach and freight wagon roads, military roads, railroads, bridges, telephone and telegraph lines, and in some cases, powerlines.

- Urban buildings – historic buildings in cities, towns, or villages not directly associated with other categories.
- Other – a large number of historic sites for which the WYCRO database does not provide enough information to allow the sites to be assigned to another category. This category constitutes more than 25 percent of the historic site type representations for the Planning Area.

National Historic Landmarks, Landscapes, and Archeological District in the Planning Area

There are several areas designated as National Historic Landmarks, Archeological Landscape Districts, or Archeological Districts in the Planning Area.

The Paint Rock Canyon Archeological Landscape District includes an extensive archeological record of Native American use of this well-defined location. In addition to the research value of the archeological sites spanning thousands of years of use, the landscape contributes to the resource's integrity and forms an essential part of the resource's cultural value. The steep nature of the canyon limited human use of the area while providing access to lithic materials for tool manufacture and rock shelters for short-term habitation.

The Black Mountain Archeological District is another NRHP-listed grouping of exceptional cultural resources values, spanning from Paleoindian occupation to the Late Prehistoric.

Refer to Section 3.7.3 *National Historic Landmarks*, which addresses the Heart Mountain Relocation Center.

3.5.1.2 Sites of Specific Concern to Native Americans

Native American Traditional Resources Possibly Present in the Planning Area, including Traditional Cultural Properties

There are no traditional cultural properties (TCPs), as defined by National Park Service Bulletin 38 (Parker and King 1998), in the Planning Area. No specific traditional gathering areas have been identified in the Planning Area. This does not mean that Native American tribes do not have resources of concern or TCPs in the Planning Area that have not been formally recognized. Certain site types are likely to be of interest to tribal groups, whether or not they are designated as TCPs or receive other recognition.

Individual Burials and Massacre/Battle Sites

Most Native American tribes believe that burials and burial sites are sacred and should not be disturbed. In addition, there are two battle sites in the Bighorn Basin – Bates Battle in the Bridger Mountains, and a recorded battle site in the Clarks Fork subregion, which is considered important to tribes in the region.

Observatories, Calendar Sites, and Petroglyphs

In general, the medicine wheel site type is considered to be a sacred site type and potentially represents a calendar associated with the seasonal variation in the region. One of the most well-known and sacred medicine wheel sites in North America is the Bighorn Medicine Wheel. This TCP is in the Big Horn Mountains in northern Wyoming, outside of the Planning Area. This site is believed to be aligned with the summer solstice and the summer stars. This medicine wheel has been modified over time, and its preservation is important to the tribes in the region. The complex also is considered sacred as it relates to vision quests and other religious activities (Eagle Bear 2009; Fisher 2009).

Petroglyphs and pictographs, stone alignments, and effigies also have sacred and special meaning to the tribes in the region. Although not entirely understood by archeologists, the symbolism represented is to be protected and preserved whenever possible (McCleary 2008; Keyser and Klassen 2001).

Trails and Trail Markers

Beyond the historically documented trails such as the Bridger Trail, Bad Pass Trail, and the Nez Perce NHT in the Bighorn Basin, cairns are often considered trail markers and are important to local tribes. Three unnamed trails in the south and west portions of the Planning Area have been identified as associated with the Eastern Shoshone (Shimkin 1947).

Geographic Features

The Bighorn Basin is considered an important geologic and geographic feature by many tribes in the region. Its horseshoe shape and towering mountain peaks are discussed in the oral traditions of the Crow and the Sioux, and the region in general has substantial meaning to these groups (Eagle Bear 2009). Specific geographic features such as mountain peaks, rivers, and landforms, including place names associated with the Planning Area, are specifically important to the Crow and the Eastern Shoshone.

3.5.1.3 Current Resource Management

BLM's Responsibilities, Policies, Acts, and Protocols Related to the Management of Cultural Resources

The BLM is legally mandated to identify, evaluate, and manage cultural resources under at least 10 federal laws and four presidential Executive Orders, most prominently the Antiquities Act of 1906, the NHPA of 1966, the NEPA of 1969, and the FLPMA of 1976, as amended, and Executive Order 11593. BLM Manuals 8100, 8110, 8120, and 8130 outline BLM policy and cultural resource program guidance. The BLM detailed its approach to managing National Historic Trails (NHTs) in the 1986 Oregon/Mormon Pioneer NHTs Management Plan. Although the Oregon/Mormon Pioneer NHT does not pass through the Planning Area, the plan (BLM 1986b) addresses overall concerns and management issues common to all NHTs. All viewsheds associated with NHTs and cultural resource locations will only be managed for those sites where integrity of setting is an important element of its eligibility for the National Register of Historic Places, which is limited to some of those eligible under 36 CFR 60.4 (a), (b), or (c), and criterion (d) in instances where setting is a factor for the site eligibility. The BLM intends to revise the plan to meet current preservation needs.

In 2012, the BLM developed an agreement addressing means of complying with NHPA, expressed in the Programmatic Agreement Among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act (BLM, ACHP, and National Conference of SHPO 2012). Pursuant to this national Programmatic Agreement, the BLM Wyoming State Office developed a specific process by which NHPA compliance is accomplished, detailed in the State Protocol between the Wyoming BLM State Director and the Wyoming State Historic Preservation Officer (BLM and Wyoming SHPO 2014). Apart from certain considerations derived from specific cultural resource statutes, management of cultural resources on public lands is primarily based on FLPMA, and is fully subject to the same multiple use principles and the same planning and decision making processes followed in managing other public land resources.

BLM Manual 8130, Planning for Uses of Cultural Resources (BLM 2004c) (incorporating Information Bulletin No. 2002-101, Cultural Resource Considerations in Resource Management Plans), expresses specific objectives for cultural resource management and provides minimum goals for cultural resource management in all RMPs.

Issues Addressed by Management Actions

Almost all the compliance investigations of prehistoric cultural resources in the Planning Area during the past 30 years have been associated with proposed development projects. Exceptions include a Class II inventory performed by the Worland District in the late 1970s that included the Planning Area. Smaller studies have sampled specific areas, such as rockshelters along the Big Horn Mountain Slope (for example, see Fenner and Kornfeld 2006).

Research concerning historic cultural resources in the Planning Area and surrounding region has included extensive attention to the major historic trails; thematic research and fieldwork concerning ranching and homesteading; recent preparation of an historic overview of one of the early automobile routes to Yellowstone National Park; historical overviews and documentation of early major oilfields and oilfield camps; historical overviews and evaluation of at least two railroads; and building surveys performed by Certified Local Governments (primarily in urban settings). Trails, abandoned railroad lines, oil field development, and stockherding campsites are often found on public lands. Other historic cultural resource types are more often found on private property or in urban settings. Outstanding rural historic resources in the Planning Area include Heart Mountain Relocation/Internment Camp, the Bridger and Bad Pass Trails, and associated sites. Funding limitations and the immediate need to comply with Section 106 in advance of development, particularly development for extractive industries, means that current research activities are generally conducted in reaction to potential impacts to specific prehistoric resources.

Use Categories

BLM Manual 8110, Identifying Cultural Resources, defines six use categories – scientific use; conservation for future use; traditional use; public use; experimental use; and discharged from management. As noted in the manual, "A cultural property may be allocated to more than one use category … Allocations should be reevaluated and revised, as needed, when circumstances change or new data become available" (BLM 2004d).

The Planning Area contains outstanding prehistoric and historic cultural resources. There are 83 resources listed on the NRHP within Planning Area boundaries. Notable among these is the Hanson Site, which could be eligible for designation as a "World Heritage" site. Other notable resources include Medicine Lodge Creek, the Legend Rock Petroglyph site, Horner Paleoindian site, Black Mountain Archeological District, Paint Rock Canyon Archeological Landscape, Heart Mountain Relocation Historic District, and a number of rock shelters. Most historic-era resources are within town limits, with notable exceptions of Bates Battlefield, Bad Pass Trail, and Mason-Lovell, T E, and Worland Ranches. In addition to the cultural resources listed on the NRHP, 864 historic properties have been formally determined to be eligible for nomination to the NRHP.

Of the approximately 8,400 recorded cultural resources in the Planning Area, more than 6,400 recorded properties (or about 76 percent) have been evaluated for eligibility for nomination to the NRHP. These evaluations include sites that have been listed on the NRHP, sites for which the Wyoming State Historic Preservation Office (SHPO) has concurred with the evaluation, and others for which the evaluation is still in process. SHPO concurrence on NRHP evaluation is desirable, and while concurrence is not a foregone conclusion, in most cases SHPO will concur with agency determinations of eligibility. Eligibility for

nomination to the NRHP is a major threshold for management consideration of the sites, as discussed below. Cultural resource properties that have been formally evaluated can be assigned to one or more of the BLM resource use classifications, but the more than 1,850 cultural resources that have not been formally evaluated for NRHP eligibility can only be assigned to use classifications in a general or categorical sense, as described below.

Scientific Use

"Scientific Use" implies that the value (or a value) of the property lies in information that can be extracted from the property. This use category usually corresponds to NRHP Criterion D, which recognizes the value to society of properties that can yield or have yielded information important in expanding understanding of history or prehistory. Archeological sites are generally evaluated under this criterion, although other kinds of cultural resources might rarely also be evaluated under this criterion. The regulatory threshold for management of a cultural resource for its scientific values is eligibility for the NRHP under Criterion D. Management opportunities include in-place preservation and protection, or extraction of the scientific information by means of excavation and analysis. In the latter case, the physical cultural resource is at least partially destroyed, and the management requirement shifts to analysis and preservation of the information extracted from the site.

This use category applies to archeological resources that have been determined to be eligible for the NRHP under Criterion D, but it also applies to all archeological resources that have not yet been evaluated for NRHP eligibility. This use category could also apply to historic archeological sites or the archeological components of building complexes or examples of extractive industry. Because BLM Manual 8110 defines scientific use as "study that would result in the property's physical alternation or destruction," this use category does not apply to sites that are not altered or destroyed through study, such as emigrant trails, railroads or historic roads, most buildings and other structures, historic graves, or sites of primarily commemorative value, including rock art sites, medicine wheels, possibly other stone alignments, and TCPs.

Conservation for Future Use

Manual 8110 (BLM 2004d) defines this category as "reserved for any unusual cultural property which, because of scarcity, a research potential that surpasses the current state of the art, singular historic importance, cultural importance, architectural interest, or comparable reasons, is not currently available for consideration as the subject of scientific or historical study that would result in its physical alteration." This use category pertains to all cultural resources regardless of age or thematic associations, unless the resources have been formally determined to be ineligible for the NRHP under all of the NRHP Criteria for Evaluation. Sites that could be of scientific value, but are not immediate candidates for study under the "Scientific Use" category, will be managed under the "Conservation for Future Use" category. Because it is not feasible for the CYFO and the WFO to test all archeological sites and otherwise evaluate the NRHP eligibility of all of the recorded cultural resources in the Planning Area, conservation for future use effectively resolves into monitoring of other public land uses, evaluating specific proposed activities that might disturb specific cultural resources, controlling erosion of the resources, and actively stabilizing the resources as appropriate.

The Bighorn Basin includes a wealth of rock art sites that fit this category, particularly in terms of research potential and singular cultural importance. With a few exceptional cases where other uses have been explicitly identified (e.g., Legend Rock and Medicine Lodge Creek), rock art should be managed for conservation. Similarly, rock shelter sites also should be managed for conservation because of their potential to preserve exceptional chronological data in cultural deposits, and the possibility of including unique artifact types.

Traditional Use

Traditional use of cultural resources is interpreted to mean use of the cultural resource by a specific social and/or cultural group that perceives the resource as important to its heritage. Cultural resources can include TCPs, which are properties critical to a living community's beliefs, customs, and practices. TCPs can be topographical features; stone alignments, rock art, or other physical artifacts; sources of plants or other materials; or areas without obvious physical manifestation of the site's cultural significance. The regulatory threshold for management of a property as a TCP is eligibility for listing on the NRHP under any of the Criteria for Evaluation, although Criterion A is most commonly appropriate for representation of an event or broad pattern in history. No resource has been specifically identified in the Planning Area as a TCP as defined in National Register Bulletin 38 (Parker and King 1998).

TCPs in Wyoming are most commonly associated with Native Americans. Because the tribes of the area were removed to reservations outside the Planning Area in the 1860s, the ensuing discontinuity of occupation and use of the Planning Area since then is likely to have resulted in loss of areas of critical importance to some living Native American communities. Rock art localities throughout the Bighorn Basin are likely candidates for the traditional use category (McCleary 2008). Protection and access limitations are recommended for most of these, with efforts made to direct public interest toward groupings that are already well known (e.g., Medicine Lodge Creek) or slated for interpretive development (e.g., Legend Rock).

Public Use

Long-term preservation and onsite interpretation are most appropriate for cultural resources that have visually obvious manifestations of the site's historical or archeological importance. This resource type is well represented by the extensive examples of rock art in the Planning Area. Although the type of onsite interpretation that invites public access to the site is usually not appropriate for cultural resources that can be easily vandalized or degraded, including most archeological sites that might be important for their scientific values, some sites are already well known and thus vulnerable to damage. The intent of interpretive efforts is that education will help preserve the site and similar examples.

All BLM-administered lands are managed for public uses of one kind or another, and there is no distinct regulatory threshold for managing cultural resources through long-term preservation and onsite interpretation. Considerations for management in this manner are (1) the relative significance of the resource within historical, archeological, or other cultural context(s), (2) the sensitivity of the cultural resource to loss or degradation as a result of increased public access, and (3) the ability of the BLM to install and maintain interpretive features and support facilities while protecting the cultural values of the site. Management under this use category is therefore likely to be driven more by practical considerations than by regulatory requirements. Onsite interpretation also is not appropriate for most Native American TCPs, because of the possible degrading effects of public presence on the setting and feeling of these locations.

Experimental Use

Experimental use is rarely appropriate for cultural resources because of the singular, nonrenewable, and typically fragile nature of the resource. However, certain archeological sites, particularly rockshelters that contain well-defined stratified deposits might be appropriate for management under this use category. Also, an archeological site where there has been past excavation or where looting has already adversely affected the integrity of part of the site, could be a candidate for experimental use. Certain lithic sources, particularly a primary source, could provide samples useful in identifying sources and possibly ages of lithic materials found in archeological sites over a wide region. The regulatory threshold

for managing cultural resources for experimental use is likely to be eligibility under NRHP Criterion D, which involves the likelihood of yielding information important to expanding knowledge of history or prehistory. Archeological sites that could be adversely affected by development or other factors could also be candidates for experimental use as mitigation for the adverse effect. The BLM remains responsible for analyzing and protecting information obtained during mitigation of potential adverse effects to cultural resources.

Discharged from Management

This use category applies to any cultural resource the BLM and the Wyoming SHPO have determined to be ineligible for nomination to the NRHP. The Planning Area contains approximately 4,950 recorded cultural resources that have been determined to be ineligible for nomination to the NRHP, have been determined to be non-contributing elements of eligible properties, or have been destroyed. Sites placed in this use category "remain in the inventory, but they are removed from further management attention and do not constrain other land uses" (BLM 2004d).

Management Challenges

The BLM's primary challenge is to achieve a balance between protecting valuable cultural resources and simultaneously making other resources available within the context of multiple use. Pressures on cultural resources will likely increase from continued mineral resource development and direct, indirect, and cumulative impacts will continue to degrade a percentage of the cultural landscape. Case-by-case inventory will prevent harm to individual sites, but the lack of comprehensive inventory coverage will continue to hamper broad-scale interpretation and assessment of cumulative effects. Inventories would probably continue at roughly 100 or more projects per year, with inventories covering approximately 10,000 acres per year. Impacts to resources for which mitigation measures could not be developed through consultation could be expected to occur once every 5 to 10 years. However, as oil and gas exploration and development increase, the potential conflicts related to cultural resources also will increase.

The demand for consumptive use of cultural resources through tourism and archeological research projects is low but is anticipated to increase through time. This reflects an increasing interest in history and recognition of the fragile nature of the resource. Historic trails, particularly those in the NHT system, could see increased visitation. Maintaining the historic setting is critical to providing a quality experience for visitors. The setting is an essential component in determining whether a particular trail segment contributes to the trail's overall significance, and preservation of the viewshed through a setting consideration zone is a management goal. Setting is also an essential aspect of NRHP eligibility for other cultural resource types such as rock art and Native American sensitive sites and potential TCPs. However, it is not as important for some types of linear sites, such as canals and some roads. For example, preservation of viewshed through setting consideration zone is not necessary for the Black and Yellow or Park to Park highways.

American Indian concerns are becoming increasingly important as development pressures and awareness of four main issues increase. First, the Native American Graves Protection and Repatriation Act charges the BLM with establishing the cultural identity of human remains and returning them to the appropriate tribal group or reburying them according to their wishes; implementation of the Native American Graves Protection and Repatriation Act requires the BLM to consult with a broad spectrum of tribal authorities to determine the tribe to which the remains and materials should be repatriated. Second, American Indian religious concerns must be addressed through consultation with various tribes who have or historically had a presence in the area. While certain types of these cultural resources are

recognizable by their physical characteristics, others can only be identified by the practitioners of the culture to which they are relevant through the consultation process and on-the-ground site visits. The third area of concern is the identification of areas where Indian Traditional Practitioners collect plants or minerals. The final issue is assurance of access to areas of traditional importance, as provided for by American Indian Religious Freedom Act. In some cases these resource areas might also be eligible TCPs requiring full compliance with NHPA Section 106.

3.5.2 Paleontological Resources

Paleontological resources are defined as any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth. Paleontological resources (or fossils) can be the remains of plants or animals (body fossils), or reflect their actions (trace fossils). Paleontological resources are typically preserved in sedimentary rocks or, in a few unique situations, igneous and metamorphic rocks. They can be microscopic, as in single-celled animals (bacteria) or pollen; or macroscopic, such as fossils of leaves, petrified wood, shells of invertebrate animals, bones, teeth, tracks, feeding traces, coprolites, and burrows. Typical public conceptions of fossils are those of animals, especially dinosaur bones or teeth, or petrified wood.

BLM Management and Protection of Paleontological Resources

Paleontological resources on public lands are managed and preserved using scientific principles and expertise. BLM policy defines important fossils as including all vertebrate fossil remains, and plant and invertebrate fossils determined, on a case-by-case basis, to be scientifically unique. Abundance of these resources varies, with some geologic formations containing few or no important fossils and other formations known to commonly produce important fossils throughout the formation. The BLM does not allow commercial collecting of fossils from public lands, except petrified wood which is managed as a mineral material and is salable under the Mineral Materials Act (43 CFR 3600); unless it is determined that it is a paleontological resource because of its paleontological interest.

Congress passed the Paleontological Resources Preservation Act (PRPA) in March 2009. This Act supplements existing laws and guidance regarding paleontological resources on BLM-administered lands (e.g., FLPMA, BLM Manual 8270, and BLM Handbook H-8270-1). To address requirements in the PRPA, the BLM issued two IMs ("Casual Collecting of Common Invertebrate and Plant Paleontological Resources under the Paleontological Resources Preservation Act of 2009," April 24, 2009 and "Confidentiality of Paleontological Locality Information under the Omnibus Public Lands Act of 2009," June 5, 2009) (BLM 2009m; BLM 2009n).

Active Paleontology Permits, Monitoring, and Mitigation Efforts

Under current policy and continuing under PRPA, the BLM allows the collection of fossils with some restrictions, depending on the significance of the fossils. The BLM allows the public to collect common invertebrate or plant fossils in reasonable quantities for personal use, making negligible disturbance using only hand tools (casual-use or hobby collecting). Vertebrate and any administratively designated plant or invertebrate fossils may be collected only under certain conditions outlined in permits the BLM issues to qualified researchers. All fossils collected under a permit remain public property and must be curated in an approved repository.

The basic permit is the "Paleontological Resources Use Permit." Any research on paleontological resources, whether fossils are collected or not, requires a permit. The BLM issues a "Survey and Limited Collection Permit" for any research, survey, and collection of surface finds, and limits surface disturbance to 1 square meter or less. If the disturbance will be more than 1 square meter or require mechanized equipment, the researcher must apply for an excavation permit. Before it can issue an excavation permit, the BLM must prepare an Environmental Assessment for the proposed location. All fossils collected under a permit remain public property and must be curated in an approved repository.

As of early 2014, the BLM Wyoming State Office has issued between 100-120 separate active paleontological resources permits involving research and/or consulting in the Planning Area (BLM 2014b).

Potential Fossil Yield Classification

The BLM utilizes the Potential Fossil Yield Classification (PFYC) system to classify the potential to discover or affect important paleontological resources. The PFYC system is intended to help determine proper mitigation approaches for surface-disturbing activities, disposal or acquisition actions, recreation possibilities or limitations, and other BLM-approved activities. The PFYC system also highlights areas likely to be a focus of paleontological research efforts or illegal collecting. There are five classes of potential fossil yield, ranging from Class 1, "No Potential," to Class 5, "Very High Potential," for vertebrate or scientifically important paleontological resources. The *Glossary* includes a complete description of PFYC system classifications. Although granite and other igneous or metamorphic rock types are usually considered to be devoid of fossils, outcrops of these rocks can have fissure fillings, cave-like structures, sinkholes, and other features that could preserve important paleontological resources or information, so the potential is not zero; therefore, the BLM applies Class 1 to these rock types usually considered not to contain fossil resources.

As shown in Map 46, approximately 79 percent of the Planning Area is classified as Class 3 or 5 geologic formations, indicating a "Moderate" to "Very High" potential for vertebrate or scientifically important paleontological resources.

Identified Paleontological Resources

The Planning Area is one of the most important areas in the northern hemisphere for the paleoecological study of global climate change. Recent and current scientific research is focused on the Paleocene-Eocene Thermal Maximum (PETM) stratigraphic zone, which provides important data about paleoclimate in the basin. This important geologic contact between the Fort Union and Willwood formations in the Bighorn Basin and adjacent strata is an internationally known marker for data on paleoclimate, carbon isotopes, past global warming, and mammalian evolution. This important geologic zone is found in several locations throughout the Planning Area, including in the Clarks Fork Basin and Polecat Bench areas, south of McCullough Peaks, the Foster Gulch area, and several areas in the southern part of the basin. Research interest focusing on these areas is expected to increase over the next planning cycle.

The Planning Area is one of the principal areas in the U.S. for paleontological research on plants, dinosaurs, dinosaur tracksites, early mammal evolution, and paleoenvironments, with a long history of producing many important dinosaur, mammal, and plant specimens.

The Brown/Howe Dinosaur Area ACEC, which includes the Big Al Quarry, includes extensive outcrops of the famous Jurassic Morrison Formation, a well-known dinosaur-fossil bearing deposit (refer to Section 3.7.1 *Areas of Critical Environmental Concern*). Coyote Basin, and other areas north of Shell, Wyoming, are large areas of exposed dinosaur-rich fossil strata on public lands. The Red Gulch Tracksite ACEC contains a world-class exposure of Jurassic dinosaur tracks exposed in the lowermost Sundance Formation. Scientists have expressed interest in building a geoscience museum in nearby Shell that would focus on the paleontological values of the area. The Big Cedar Ridge ACEC contains outcrops of Cretaceous Meeteetse Formation that produce extremely well preserved plant fossils in a 72-million-year-old mudflow of volcanic ash. Natural Trap Cave, in the Little Mountain ACEC, is famous for producing fossils of Pleistocene-age mammals and other animals that fell into the cave and were preserved.

Important Fossil-bearing Strata in the Planning Area

Known fossil deposits in the Planning Area represent the past 543 million years, including the Paleozoic Era, virtually all of the Mesozoic Era (Age of Reptiles), and a major portion of the Cenozoic Era (Age of Mammals). Table 3-37 lists important fossil-bearing strata in the Planning Area, including some of the types of fossils within each strata, by decreasing geologic age. Only a few of the many different types of invertebrate and vertebrate fossils found in the formations are listed in the table and the list is not all inclusive.

The Jurassic Period Morrison Formation is known for its rich dinosaurian fauna (e.g., bones, teeth, skin impressions, eggshells, and trace fossils), and the Sundance Formation is important for its marine reptiles, trace fossils, and important invertebrate fossils.

Cretaceous strata in the Bighorn Basin have yielded important paleontological finds. In particular, outcrops of the Cloverly, Meeteetse, and Lance Formations produce dinosaur bones, while outcrops of the Thermopolis Shale and Mowry Shale produce the fossil bones of marine reptiles. The Meeteetse Formation has produced hadrosaur (duckbill dinosaur) bones and skin impressions in the Elk Basin area, and hadrosaur bones near Meeteetse. Fossil bones and teeth of the dinosaurs *Deinonychus* and *Tenontosaurus* have been found in many localities from the Cloverly Formation. The Paleocene/Eocene Willwood Formation occurs throughout the Bighorn Basin and is considered a world-class fossil resource in the field of mammalian paleontology and paleoclimate. These geologic zones are found in various locations throughout the Planning Area. Research interest focusing on these areas is expected to increase (BLM 2008f; Breithaupt 1996; Druckenmiller 2002; Eicher 1962; Love and Christiansen 1985).

Table 3-37. Geologic Age of Fossil-Bearing Strata in the Bighorn Basin

Formation or Deposit	Era	Period	Fossils Found within Unit
Cottonwood Canyon Member of Madison Limestone	Paleozoic	Devonian/Mississippian	Fossil Fish
Gypsum Spring Formation	Mesozoic	Jurassic	Vertebrate/Trace Fossils/Tracks
Sundance Formation	Mesozoic	Jurassic	Vertebrate/Invertebrate/Trace Fossils
Morrison Formation	Mesozoic	Jurassic	Vertebrate/Dinosaurian Fossils, Microvertebrates
Cloverly Formation	Mesozoic	Cretaceous	Vertebrate/Dinosaurian Fossils
Thermopolis, Mowry, Frontier, Cody shales	Mesozoic	Cretaceous	Vertebrate/Marine Reptiles and Fish Fossils
Meeteetse Formation	Mesozoic	Cretaceous	Vertebrate/Dinosaurian Fossils, Plant Fossils
Lance Formation	Mesozoic	Cretaceous	Vertebrate/Dinosaurian Fossils
Fort Union Formation	Cenozoic	Paleocene	Vertebrate/Mammalian Fossils, Plant Fossils
Willwood Formation	Cenozoic	Eocene	Vertebrate/Mammalian Fossils, Plant Fossils
Tatman Formation	Cenozoic	Eocene	Vertebrate/Mammalian Fossils, Plant Fossils
Wiggins Formation	Cenozoic	Eocene	Vertebrate Fossils
Terrace, colluvial, alluvial, glacial, eolian or cave deposits	Cenozoic	Quaternary/Pleistocene	Vertebrate Fossils

Sources: BLM 2008f; Breithaupt 1996; Druckenmiller 2002; Eicher 1962; Love and Christiansen 1985.

Paleontological Resources Management

Special Management Designations for Paleontological Resources

Four existing ACECs in the Planning Area have been identified for their paleontological values – Big Cedar Ridge, Red Gulch Dinosaur Tracksite, Brown/Howe Dinosaur Area, and Little Mountain. In addition to these existing ACECs, four areas have been nominated as new ACECs based on their paleontological values – the Clarks Fork Basin/Polecat Bench West Paleontological Area, the McCullough Peaks South Paleontological Area, the Foster Gulch Paleontological Area, and the Rainbow Canyon Area. Refer to Section 3.7.1 *Areas of Critical Environmental Concern* for information on these existing and proposed ACECs.

Management Challenges

The BLM manages paleontological resources for the overall benefit of the public, which can include research, preservation, interpretation and museum display, and recreation. While implementing regulations under the PRPA have not been issued at this time, the BLM is required to "manage and protect paleontological resources on federal land using scientific principles and expertise." Until the implementing regulations are issued, the BLM will continue to follow the policy and guidelines discussed above under *BLM Management and Protection of Paleontological Resources*.

Scientific Use

Balancing the needs of scientific research and public recreation (including hobby collecting and onsite interpretation and development) against preservation of the resource presents a challenge for the BLM. The primary resource indicator for paleontological resources is whether there is a loss of characteristics that make the fossil locality or feature important for scientific use or public education and enjoyment. Natural or accelerated erosion, decay, improper collection, and vandalism can remove, alter, or damage characteristics that make the paleontological resource scientifically important or enjoyable to the public.

The BLM management of research efforts is relatively indirect and limited, primarily responding to requests from scientific researchers for paleontological use permits. At present, there are more than 100 active permits for the Planning Area, and the number of requests for use permits is expected to increase in the future.

Public Use: Recreational Visits and Hobby Collecting

The BLM allows hobby collecting of common varieties of invertebrate or plant fossils and petrified wood throughout the Planning Area. Invertebrate fossils can only be collected in reasonable quantities for personal use while making a negligible disturbance and using only hand tools; unrestricted collecting is not allowed. Petrified wood can be collected for personal use in quantities of up to 25 pounds per day, but is limited to no more than 250 pounds per year. Because of a lack of information, at this time it is not possible to identify specific areas where unsupervised hobby collecting could occur; further study might determine that there are such areas and that collecting activities can occur in those areas. Concentrating people at a developed site often increases adverse impacts to that site and the resource through increased vehicle and foot traffic and exposure to vandalism.

Regional Population Growth

Increasing visitation to public lands due to increased population could result in both intentional and unintentional damage to paleontological resources as a result of collection, vandalism, surface disturbance, and other depreciative behavior. Remote areas once protected by their distance from populated areas, are now within reach of hikers, OHV users, and nearby residents. In addition, paleontological resources in the Western United States, including sites where dinosaur bones have been found, are attracting visitors from all over the world to areas where they could adversely affect fragile resources through overuse.

Vandalism and Looting

Throughout the decades, public lands have been an easy target for thieves and looters, and the plundering and destruction of paleontological resources has become a highly lucrative business involving a network of looters and buyers in the United States and elsewhere. Most fossils taken from public lands are difficult to track to their place of origin.

Localities known to contain commercially valuable fossils are the primary targets of looters, although objective estimates of the extent of damage and destruction to such places are hard to develop.

3.5.3 Visual Resources

The BLM has a basic stewardship responsibility to identify and protect visual values on public lands (BLM 1986c). To accomplish this, visual values are systematically identified and evaluated to determine appropriate management objectives. BLM policy guidance for Visual Resource Management (VRM) of BLM-administered public lands has not changed or been updated since the early 1980s. The following paragraphs describe the VRM system and visual resource inventory (VRI) process.

Visual Resource Inventory

As mandated by Section 201 of the FLPMA, the BLM prepares and maintains visual resource inventories to identify visual values for all public lands (BLM 1986c). The CYFO completed a new visual resource inventory in January 2009. The WFO reviewed and updated its visual resource inventory for all lands south of the Greybull River in winter and early spring 2009. This RMP and EIS incorporate the updated visual resource inventory information. See Appendix X for additional information on the visual resource inventory.

The VRI process uses three primary components to determine visual values within the Planning Area: Scenic Quality Evaluation, Sensitivity Level Determination, and Delineation of Distance Zones. Scenic Quality is evaluated based on an area's landform, vegetation, color, adjacent scenery, scarcity, and the level of human modification. The BLM rates the Scenic Quality of an area as an A, B, or C; A areas are the most scenic, and C are the least. Sensitivity Level is determined based on the type of users of a given area, the amount of use, public interest in the area, adjacent land uses, and any special designation (such as WSA) in the area. Based on these factors, the BLM rates an area's visual resources as having either high, medium, or low sensitivity levels. Landscapes are also divided into three Distance Zones based on their visibility from travel routes or Key Observation Points: foreground-middleground, background, and seldom seen areas. The foreground-middleground zone includes areas seen from highways, rivers, or other viewing locations which are less than 3 to 5 miles away. Seen areas beyond the foreground-middleground zone, but usually less than 15 miles away, are in the background zone. Areas not seen as foreground-middleground or background (i.e., hidden from view) are in the seldom-seen zone. Because of the dense travel network within the Bighorn Basin, no areas were classified as background, or seldom seen; the only Distance Zone classification in the Planning Area is foreground-middleground.

Based on Scenic Quality, Visual Sensitivity, and Distance Zone, BLM-administered lands are placed into one of four VRI classes. These inventory classes represent the relative value of the visual resources and are informational in nature. Classes I and II are the most valued, Class III represents a somewhat lesser value, and Class IV represents the least value (due to low scenic quality or substantial development). Changes in sensitivity levels and scenic quality in the Planning Area have resulted in changes to the VRI. Some areas moved from Class II and III to IV, and other areas from III and IV to II. Special Areas, such as WSAs, are automatically rated as visual resource inventory Class I. Table 3-38 provides an illustration of the basis for determining VRI classes based on the components of Scenic Quality, Visual Sensitivity, and Distance Zones.

Table 3-38. Visual Resource Inventory Classes

		Visual Sensitivity Levels						
		High			***Medium***			***Low***
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III[1] IV[1]	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	b	s/s	f/m	b	s/s	s/s

Source: BLM 1986c

Distance zones: f/m = foreground-middleground, b = background, s/s = seldom seen areas

[1]If adjacent areas are Class III or lower then Class III is assigned. If adjacent areas are higher than Class III, then Class IV is assigned.

Table 3-39 includes the acreage for each VRI component sorted by rating (Scenic Quality, Sensitivity Level, and Distance Zone) in the Planning Area along with the resultant VRI classes. The VRI classes provide the baseline for visual resources in the Planning Area and are the indicator of visual values against which the impacts from VRM under the various RMP alternatives are measured. Maps showing the scenic quality evaluations, sensitivity levels, and VRI classes for the Planning Area are provided in Appendix X.

Table 3-39. Visual Resource Inventory Component and Class Ratings

Inventory Component and Rating	Acres (BLM-administered surface)
Scenic Quality Evaluation[1]	
A	1,333,214
B	1,017,932
C	699,458
Special Areas[2]	141,000
Sensitivity Level Determination[3]	
High	1,013,970
Medium	479,435
Low	1,557,200
Special Areas[2]	141,000
Distance Zone[4]	
Foreground/Middle Ground[4]	3,046,814
Special Areas[2]	141,000
Visual Resource Inventory Class	
Class I	140,971
Class II	984,812
Class III	384,589
Class IV	1,681,176
Not Rated[5]	37

Sources: BLM 2013a; BLM 2009e.

[1]A-rated lands are the most scenic, C-rated lands are the least.
[2]Special Areas include Wilderness Study Areas and other federal agency's surface land. These areas are either required to be managed as VRM Class I and therefore automatically placed into VRI Class I (e.g., WSAs on BLM-administered surface) or are managed under other agencies' VRM procedures and therefore not assigned to a VRI class (e.g., National Recreation Area lands around Yellowtail Reservoir). As a result, numbers may exceed total of all BLM-administered lands in Planning Area due to slight overlap in class ratings. For both cases, lands classified as Special Areas are not rated for Scenic Quality, Visual Sensitivity, or Distance Zone.
[3]High, medium, or low sensitivity levels are based on factors including amount of use, public interest, and adjacent land uses.
[4]The only distance zone in the Planning Area is Foreground/Middle Ground. Foreground-Middleground is the area seen for a distance of 3 to 5 miles.
[5]Surface lands managed by another federal agency, such as the National Park Service. These areas are not assigned to a VRI class.

BLM Bureau of Land Management

Visual Resource Management Classes

The BLM considers visual values along with other resource values in the RMP process. Based on the VRI, along with other resource values and opportunities in a given area, the BLM establishes visual objectives for VRM. The BLM conducts visual resource inventories for all lands in the Planning Area; however, only BLM-administered lands are managed within the VRM system. Approved VRM objectives according to each VRM Class (see below; not to be confused with VRI classes) provide visual management standards for the design and development of projects on the public lands. The specific objectives for the four VRM classes are as follows:

- **Class I Objective.** The objective for this class is to preserve the existing character of the landscape. This class provides for natural ecological change; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- **Class II Objective.** The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **Class III Objective.** The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV Objective.** The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic landscape character elements. (Note that Class IV areas are not necessarily of low scenic quality).

Visual Contrast Rating and Design Principles

The VRM system is designed to separate the existing landscape and proposed projects into features (landforms and water, vegetation, and structures), and landscape character elements (form, line, color, and texture) to compare each part to the other to identify parts that are not in harmony. The BLM uses the visual contrast ratings (BLM 1986d) to analyze proposed projects during the environmental review process. Visual contrast ratings determine whether proposed projects meet established VRM objectives. They also are a valuable tool to identify visual impacts and to identify effective means to mitigate them. Basic landscape design principles, which include repeating landscape character elements, minimizing surface disturbance, and proper siting and location, are invaluable to design (or re-design) projects to minimize adverse visual impacts.

Visual Resource Management within the Planning Area

Important Visual Resources

There are many highly scenic areas in the Planning Area. The landscape exhibits a high degree of variability in the visual environment. The Planning Area contains open rolling hills, low mesas, badland areas, small mountain ranges, scenic river valleys, narrow, deep canyons, and dramatic colorful ridges. Specific scenic areas in the Planning Area include the slopes of the Big Horn and Absaroka mountains; badland areas such as McCullough Peaks, Fifteenmile area; dramatic landforms like Sheep Mountain, Carter Mountain, and Bald Ridge; portions of the Bighorn River corridor; Heart Mountain; and the numerous canyons along the west slope of the Big Horns. Rattlesnake and Cedar mountains, along with the Shoshone River canyon, frame the major travel corridor between Cody and Yellowstone National Park. The Wind River Canyon into Thermopolis, and Highways 16, 14, and 14a offer high scenic qualities to the casual observer as they enter the basin. Table 3-39 provides a quantitative summary of the ratings under each of the VRI components.

VRM Classes and Associated Acreages

Table 3-40 lists acreages by VRM class for all lands in the Planning Area. Lands in VRM Class I are WSAs and the Five Springs Falls ACEC. Lands not rated include the Bighorn Canyon National Recreation Area and Buffalo Bill State Park. Map 47 shows existing VRM classes in the Planning Area.

Table 3-40. Visual Resource Management (VRM) Classes

VRM Class	Acres (BLM-Administered Surface)
Class I	141,127
Class II	340,784
Class III	890,482
Class IV	1,815,043
Not Rated	23

Sources: BLM 1988a; BLM 1990; BLM 1998a; BLM 2013a.

BLM Bureau of Land Management

Visual Resource Conditions

While a large proportion of BLM-administered lands in the Planning Area are classified as VRM classes III and IV, most of the Bighorn Basin retains a fundamentally natural appearance and has notable scenic quality. Few areas are visually degraded by industrial activity and those that have undergone development (for example, the Elk Basin oil field northeast of Cody) have a very high potential to be restored to natural-appearing scenic landscapes. The Planning Area also contains fairly rugged landscapes with considerable visual variety. Landscapes such as these have the capacity to absorb visual intrusions and limit adverse impacts of development on the scenic quality of the landscape.

Types of Visual Intrusions

Visual intrusions on BLM-administered lands in the Planning Area include oil and gas fields, bentonite mining, the network of roads and highways, powerlines and various facilities needed to support mineral development, recreation, range improvements, and other facilities and infrastructure. Overall, other than the pockets containing a significant amount cultural modifications (such as Hamilton Dome, Grass Creek, Oregon Basin, and Elk Basin to name a few), the development in the Planning Area has left a small footprint and has not substantially changed the visual character of the area.

Management Challenges

Management challenges for VRM in the Planning Area remain essentially unchanged over the last 20 years. Management challenges for visual resources typically result from development associated with minerals and ROWs. An emerging management challenge for VRM in the Planning Area could result from renewable energy development. There could be wind-energy development projects in the Planning Area during the planning cycle because of wind potential and current policy direction for renewable energy development on public lands. Additional discussion on policies relevant to renewable energy production on public lands is included in Section 3.6.2, *Renewable Energy.* Due to the height and size of wind turbines and the locations of areas with high wind potential (usually along ridgelines, hills, or other highly visible areas) impacts to visual resources can be especially intrusive and difficult to mitigate. If development of wind energy occurs in the Planning Area, the BLM will face management challenges in meeting visual resource objectives in these areas.

Another challenge for VRM is the growing and expanding development of bentonite extracting activities. Currently, BLM-administered public lands managed under VRM Class II objectives overlay desirable bentonite beds. A recent increase of bentonite plans of operations have been located in VRM Class II, which provides a challenge to authorize the mining activity while maintaining Class II objectives.

3.6 Land Resources

Land Resources include the individual resources of lands and realty, renewable energy, ROWs and corridors, comprehensive travel and transportation management (CTTM), recreation, wilderness characteristics, and livestock grazing management. The following sections describe each resource, its existing condition, and management challenges.

3.6.1 Lands and Realty

The lands and realty program manages the underlying land base that supports all resources and management programs in the Planning Area. Management decisions for lands and realty are limited to BLM-administered public lands, though lands and realty actions during the life of the RMP could involve other surface managers. The primary activities of the lands and realty program include (1) land use authorizations such as ROWs, leases, and permits; (2) land tenure adjustments, including sales and other types of disposal actions, exchanges, donations, acquisitions of lands and interests in lands (i.e., access easements); (3) withdrawals, classifications, and segregations; and (4) management of land boundaries. As part of the processing of lands and realty actions, the BLM works cooperatively with other federal agencies, the state of Wyoming, cities and counties, and public and private landholders.

Land Status

The BLM administers 3,187,814 acres (56 percent) of surface lands in the Planning Area (Table 3-41). Private land ownership accounts for the second largest amount of surface land ownership in the Planning Area. Of the four counties in the Planning Area, Big Horn County contains the largest amount of BLM-administered land (Table 3-42).

Table 3-41. Surface Ownership in the Planning Area

Surface Manager	Planning Area Total Acres	Planning Area Percentage
Bureau of Land Management	3,187,267	56.5
National Park Service	15,645	0.3
State of Wyoming	418,659	7.4
Bureau of Reclamation	86,193	1.5
Private	1,919,656	34.0
Water	12,643	0.2
Other	3,777	0.1
Total	**5,644,868**	**-**

Source: BLM 2013a

Table 3-42. Acres of Bureau of Land Management-Administered Lands and Federal Mineral Estate in the Planning Area

County	BLM-Administered Land	Federal Mineral Estate[1]
Big Horn	1,157,920	1,288,238
Hot Springs	500,631	741,151
Park	624,870	1,049,904
Washakie	903,846	1,123,281
Total	**3,187,814**	**4,203,213**

Source: BLM 2013a

[1]The acreages listed for BLM-administered federal mineral estate do not include United States Forest Service lands.

BLM Bureau of Land Management

The BLM administers 4,203,213 acres of federal mineral estate in the Planning Area (Table 3-42). The CYFO extends west beyond the Planning Area boundary, but the USFS and the National Park Service manage these lands and the associated mineral estate, and they are not further addressed in this RMP and EIS. Although the BLM administers the leasing of the mineral estate underlying USFS and BOR withdrawn lands, mineral management decisions on these lands are made by the surface management agency. On many of the private lands, the mineral estate (all of the minerals or portions of the minerals) is reserved to the U.S. Government. In these cases, the BLM administers the mineral estate and the private landowners administer the surface estate. These lands are referred to as split-estate (ownership) lands.

Land Use Authorizations

Land use authorizations include various authorizations to use public surface for leases, including ROWs under Section 501 of FLPMA, permits, and easements under Section 302(b) of FLPMA; Recreation and Public Purposes (R&PP) leases under the R&PP Act of June 14, 1926 (43 U.S.C. 869 et seq.); and airport leases under the Federal Public Airport Act of 1928, as amended (49 U.S.C. Appendix, Sections 211-213). This section briefly describes land use authorizations and the authorizing regulations for these lands and realty actions.

Rights-of-Way

FLPMA Section 501 authorizes the BLM to grant ROWs for infrastructure and facilities that are in the public interest and require ROWs over, under, upon, or through BLM-administered lands. Most ROW applications in the Planning Area are for linear developments such as roads, pipelines, and other associated infrastructure. Refer to Section 3.6.3 *Rights-of-Way and Corridors* for a detailed description of ROWs in the Planning Area.

Leases, Permits, and Easements

Section 302(b) of FLPMA authorizes the BLM to issue leases, permits, and easements for the use, occupancy, and development of public lands. The field offices in the Planning Area administer six long-term special land use permits, three of which authorize farming on 60 total acres. In addition, an average of seven short-term permits are managed in the Planning Area each year, which can include

short-term permits for commercial filming projects. The BLM has never authorized easements for public land use in the Planning Area.

Recreation and Public Purposes Act Leases and Conveyances

The R&PP Act authorizes the BLM to lease or convey public surface to state and local governments and qualified nonprofit organizations for recreation and/or public purpose uses. Examples of typical uses under the R&PP Act include historic monument sites, campgrounds, schools, parks, public works facilities, and hospitals. Lands are typically leased first until development of the site is completed and then, if appropriate, the BLM may convey a title. Lands proposed to be leased or conveyed under the R&PP Act must first be classified as suitable for such use. R&PP classifications segregate the land from operation of the public land laws other than the R&PP Act; the R&PP Act precludes disposal by sale, exchange or other means, but specifically allows for R&PP lease or conveyance. R&PP classifications also segregate areas from operation of the mining laws, closing the area to mining of locatable minerals. R&PP classifications do not segregate areas from mineral leasing. R&PP leases and conveyances reserve all minerals in the land to the United States.

The BLM administers 12 R&PP patents covering 2,744 acres, including 3 pending covering 537 acres. In addition, there are a total of seven R&PP leases; six covering 435.5 acres and one pending lease application totaling 440 acres. Table 3-43 lists existing and pending R&PP leases in the Planning Area.

Table 3-43. Existing and Pending Recreation and Public Purpose Act Leases in the Planning Area

Current Leases	Lessee	Acres
Cody Archery Range	City of Cody	96
Lovell Gun Range	Big Horn County	136
Wapiti Fire Station	Fire District	2
Moonrock Equestrian Area	Washakie County	127.5
Radio-Controlled Model Airplanes	Washakie County	34
Thermopolis Radio Control Club	Hot Springs County	40
Current Total	**-**	**435.5**
Pending Leases (applications in process)	**Lessee**	**Acres**
Bighorn Bow Hunters-Archery Range	Hot Springs County	440
Pending Total	**-**	**440**

Source: BLM 2009a

Airport Leases/Grants

Six communities in the Planning Area have an associated public airport – Powell, Cowley, Greybull, Worland, Thermopolis, and Cody. In 1950, the BLM conveyed 650 acres of public land to Big Horn County/City of Greybull for the Greybull Airport, with an additional 70 acres proposed for a runway expansion. In 2004, the BLM conveyed 80 acres of public land to the City of Worland to allow shifting of the primary runway and an extension of the runway and taxiway at the Worland Municipal Airport. The BLM has not received any other airport or airway applications. Refer to Appendix M for additional details pertaining to airport grants.

Unauthorized Use, Trespass, and Illegal Dumping

Unauthorized use and trespass are the use, occupancy, or development of public land or its resources without a required authorization, or in a way that is beyond the scope and terms and conditions of an authorization; this definition excludes uses defined as casual use in the regulations (43 CFR 2920.1-2[a]).

Some trespass actions, such as illegal dumping, can cause unmitigated damage to public lands and natural resources. In the event the BLM is not able to identify a responsible party, the cost to resolve trespass and to clean up and reclaim the affected public land is often passed on to the general public. These costs direct appropriated funds away from planned work, and affect the BLM's ability to complete its mission. In addition, the public does not receive fair market value for use of the public lands, lands that could be otherwise available for use can become unavailable.

Trespass has been an ongoing problem in the Planning Area. Limited staff and funding is a contributing factor allowing trespass to continue unabated. When trespass actions go undetected or are not addressed, there is no incentive to cease and no deterrent to further trespass action. Known illegal activities include placement of beehives; indiscriminate dumping of trash, debris, and household wastes; farming/irrigation of public land; corrals; fences; and construction of roads and other utility-related features. Agriculture trespass and trash dumping are the most common, with numerous small-acreage areas involved. There are no known hazardous material issues associated with permitted facilities. An inventory of closed landfills in 2007 indicated there are no problem areas that need to be addressed in the CYFO; there has been no similar inventory for the WFO portion of the Planning Area.

In the CYFO Planning Area, there are more than 30 substantial (1 to 5 acres or more) unresolved trespass cases, and another 60 to 70 possible cases involving less than 1 acre in the CYFO. In the WFO, there are 57 documented cases of realty trespass and one documented case of ROW trespass. Typically, 3 to 5 cases are resolved each year, with some situations requiring a formal land survey to determine property boundaries. There is a potential for other unauthorized agricultural and occupancy trespass situations to occur in the Planning Area.

Land Tenure Adjustments

Scattered parcels of BLM-administered land can be difficult to manage as part of the public land system. In many cases, the small size of the scattered parcels, their isolation from other parcels of public land, and lack of legal access can make them of marginal utility for retaining in public ownership. Occasionally, these isolated parcels can serve other resource purposes, such as providing wildlife habitat in an area that has been fragmented by suburban development or providing recreational facilities.

Land tenure (or land ownership) adjustment refers to lands and realty actions that result in the retention or disposal of BLM-administered lands, or BLM acquisition of non BLM-administered lands or interests in lands. The FLPMA requires that public land be retained in public ownership unless, as a result of land use planning, disposal of certain parcels is justified. Parcels of land designated as potentially available for disposal are more likely to be conveyed out of federal ownership through an exchange rather than a sale. Prior to disposal of federal lands, the BLM conducts additional analysis including preparation of a mineral potential report and standards for boundary evidence certificate(s). Acquisition of and interests in lands are important components of the BLM land tenure adjustment strategy. Acquisition of and interests in land can be accomplished through several methods, including exchange, purchase, donation, and condemnation. Voluntary purchases or exchanges from willing sellers, including easements, are common methods used to increase access to public lands. Appendix M contains detailed information regarding land retention, acquisition, and disposal.

The BLM acquires lands and interests in lands to accomplish the following actions:

- To allow for access to BLM-administered lands across private lands.
- To improve management of public land resources through consolidation of federal, state, and private lands.
- To secure key property necessary to protect endangered species, promote biological diversity, increase recreational opportunities, and preserve archeological and historical resources.
- To implement specific acquisitions authorized or directed by acts of Congress.

Exchanges

Exchange is the process of trading lands or interests in lands. Conducted under the authority of Section 206 of the FLPMA, land exchanges are a tool that enables the BLM and other landowners to improve land management, consolidate ownership, and protect environmentally sensitive areas. By exchanging public land that is isolated and difficult to manage, the BLM is able to acquire other lands with importance for recreation, wildlife, fisheries, wetlands, habitat for threatened and endangered species, wilderness, open space, scenic, cultural, and other resource conservation purposes. Land exchanges allow the BLM to reposition lands into more manageable units and to meet community expansion needs.

Exchanges are the primary means by which the BLM acquires land. Except for exchanges that are congressionally mandated or judicially required, exchanges are voluntary and discretionary transactions with willing landowners. Lands to be exchanged must be of approximately equal monetary value and in the same state. Exchanges must also be in the public interest and conform to applicable BLM land use plans and other relevant guidance.

There has been only modest exchange activity in the Planning Area, although interest in exchanges continues to increase. The most recent land exchanges were the Hoodoo Ranch/Hunt Oil Exchange (7,848 acres conveyed, 6,487 acres acquired) in 1995 and the Great Western Exchange (6,894 acres conveyed, 2,399 acres acquired) in 1999. Another recent exchange resulted in the acquisition of 2,839 acres of private land in the South Big Horn Mountains area. Appendix M contains additional detailed information regarding BLM land exchanges and sales.

Purchases

Under Section 205 of the FLPMA, the BLM has the authority to purchase lands or interests in lands. Similar to other acquisitions, purchase is used to acquire key natural resources or to acquire legal ownership of lands that enhance the management of existing public lands and resources. Acquisition of lands through purchase helps consolidate management areas to strengthen resource protection. Given the limited funds available through appropriations, the BLM acquires lands through purchase sparingly. Depending on the designation and land ownership pattern, private, State or Bureau of Reclamation lands surrounded by BLM-administered public lands managed as a special designation, such as ACECs or WSAs, may be considered for acquisition.

The BLM recently completed several land purchases in the Planning Area using Land and Water Conservation funds. Two such purchases were completed in 2003 and involved lands associated with distinct management areas – a 160-acre in-holding in the Brown/Howe Dinosaur Area ACEC near Shell, and 8,200 acres in the Little Mountain area near Lovell. The BLM recently purchased 153 acres along the Bighorn River to secure property along the river for public access and wildlife habitat. An additional 1,179 acres of land within the Craig Thomas SMA was acquired in 2010 with Land and Water Conservation Funds.

Acquiring access easements across non-federal lands for roads and trails provides for legal public access to "landlocked" public lands. Easement acquisition has been a long-term effort in the Planning Area, largely because of the scattered land pattern in many areas. The BLM usually purchases access easements using appropriated funds, although some have been donated. Most access easements provide legal public vehicular, foot, or horseback access on roads or trails to large blocks of federal land. The BLM currently manages 110 easements acquired for public access across non BLM-administered land in the Planning Area.

Donations and Condemnations

The BLM occasionally receives gifts or donations of lands or interests in lands when an entity elects not to receive the market value for the interests being conveyed. A donation of $100,000 from the Rocky Mountain Elk Foundation was part of the Devils Canyon Ranch acquisition in 2003. The BLM has not acquired any lands in the Planning Area through condemnation.

Land Disposal

Public lands have potential for disposal when they are isolated and/or difficult to manage. Disposal actions are usually in response to public requests, such as community expansions. Disposals result in a title transfer, wherein the lands leave the public domain. The BLM coordinates all disposal actions with adjoining landowners, local governments, and current land users.

The BLM manages public sales under the Section 203 disposal criteria of FLPMA. Public lands determined suitable for sale are offered on the initiative of the BLM or through a nomination/request for sale from the public. The BLM does not sell lands at less than fair market value.

Appendix M and Map 51 describe and show properties identified for disposal or retention. Tracts of land designated in this RMP as potentially available for disposal are more likely to be conveyed out of federal ownership through an exchange rather than a sale.

Section 209 of the FLPMA specifies that all minerals underlying public lands disposed of by sale shall be reserved to the United States, unless there are no mineral values in the lands or the reservation of mineral rights to the United States is interfering with or precluding appropriate non-mineral development of the land, and such development is a more beneficial use of the land than mineral development.

Section 209 of FLPMA also specifies the conditions under which mineral rights will be conveyed, including payment of the administrative costs of the sale, payment of fair market value for the mineral rights, and conducting an exploratory program. Mineral rights may be sold with the land surface, sold as a separate transaction, or retained by the United States. In the Planning Area, the BLM has conveyed mineral rights only in conjunction with the sale of lands.

Approximately 115,905 acres of public lands are currently identified for disposal by sale. However, little public land has actually been offered for sale under FLPMA. Four parcels have been sold in the last 11 years, as follows:

- In 2003, the BLM sold 0.99 acre to Hawkins and Powers, Inc., for a parking lot for an airplane museum near Greybull.
- In 2002, the BLM sold 30 acres to Robert G. Griffin for the existing Grass Creek Sawmill site, which was previously authorized under a long-term lease.
- In 2006, the BLM sold 3.75 acres to the Mary A. Clay Revocable Trust to resolve an inadvertent trespass issue.

- The BLM has identified (and Congress has authorized) approximately 16,122 acres of land (the Westside Irrigation Project) for conveyance to local farmers for development as farm land (private land ownership). Pending inventory of these lands, some or all will be disposed from BLM ownership. The BLM will retain lands in this area not disposed of and will manage those lands consistent with adjacent BLM-administered lands.

Retention

Lands identified for retention in the Planning Area are BLM-administered lands not identified for disposal and lands not currently classified for disposal (e.g., R&PP Lands and Desert Land Entry [DLE] Lands). The BLM has identified a total of 3,071,909 acres for retention in the Planning Area.

Desert Land Entries

Congress passed the Desert Land Act on March 3, 1877, to encourage and promote the economic development of arid and semiarid public lands in the western United States. The purpose of the Act is to permit reclamation by irrigation of arid public land through individual effort and private capital. Arid lands capable of producing a reasonable cash agricultural crop using irrigation may be considered for a DLE. The lands must be untimbered, surveyed, unreserved, and unappropriated. If an applicant meets the final proof requirements of a DLE, a patent to the legal title of the land may be conveyed.

Most of the lands suitable for agricultural development in the Planning Area have already been placed into private ownership. With the problems of finding suitable public land, limited water available for irrigation, and the high cost of development, it is difficult to acquire a DLE under the 1877 Desert Land Act, but Act authority remains available.

A total of 1,409 acres are currently classified as suitable for entry under the Desert Land Act. There were DLE conveyances in 2003 west of Greybull (280 acres) and two DLE conveyances in 1999 (a total of 457 acres), also in Big Horn County. Since the previous RMPs, the BLM has received a number of DLE applications, but the BLM has not processed the applications because of other higher priority workload commitments, such as energy development. Additional details regarding BLM processes for desert land entries are located in Appendix M.

Withdrawals and Classifications

Lands are withdrawn under various legal authorities, including Acts of Congress. A withdrawal is a formal action that withholds an area of public land from settlement, sale, location, or entry under some or all of the public land laws; or segregates (closes) the area to mineral entry (locatable mineral development) or mineral leasing (leasable mineral development). Withdrawals are made with the purpose of limiting activities under those laws to maintain other public and resource values in the area, to reserve the area for a particular public purpose or program, or to transfer jurisdiction over an area of federal land from one department, bureau, or agency to another. Withdrawals are established for a wide range of public purposes, including military reservations, reclamation projects, and power-site reserves.

Existing withdrawals in the Planning Area have been established to protect resource values and to transfer jurisdiction to other federal agencies to accomplish their missions and goals. Withdrawals may be subsequently relinquished, in which case the land may be returned to its original jurisdiction. Withdrawn lands no longer needed by the agency for which the lands were withdrawn and have been relinquished by the agency, that are suitable for return to the public land status, will be managed by the BLM. Table 3-44 lists existing and proposed withdrawals, classifications, and other segregations in the Planning Area.

Table 3-44. Existing and Proposed Withdrawals, Classifications, and Other Segregations in the Planning Area

Field Office	Name	Acres[1]	Segregates/Withdrawals from	
			Disposal	*Locatables*
	Resource Protection			
CYFO	Stock Driveway	37,297	■	
WFO	Stock Driveway	60,452	■	
CYFO	Cave and Karst Areas	0		■
WFO	Cave and Karst Areas[2]	8,560		■
CYFO	Spirit (Cedar) Mountain Cave	234	■	■
CYFO	Horsethief/Natural Trap Caves	519	■	■
WFO	Big Cedar Ridge Paleontological Area	264	■	■
WFO	Red Gulch Dinosaur Tracksite	1,798	■	■
WFO	Castle Gardens Recreation Site	110	■	■
CYFO	Beck Lake Scenic Area (Proposed)	708	■	■
CYFO	Heart Mountain National Historic Landmark	72		■
	Management Areas			
CYFO	ACECs	11,935		■
WFO	ACECs[2]	22,239		■
CYFO	Wild and Scenic Rivers	4,518		■
WFO	Wild and Scenic Rivers	12,129		■
	Other Segregations			
CYFO	Cody Industrial Park	0		■
WFO	BLM-Wyoming State Office Public Water Reserve	2,140	■	
CYFO	BLM-Wyoming State Office Public Water Reserve	625	■	
WFO	BLM-Wyoming State Office Power Site Reservation	159	■	■
CYFO	BLM Power Site Reservation	3,308	■	■
	Other Federal Agency Withdrawals			
WFO	Power Site Classification (FERC)	1,249	■	■
CYFO	Power Site Classification (FERC) (Clarks Fork of the Yellowstone and Bighorn rivers)	15,696	■	■
CYFO	Department of Defense (Lovell Military Training Area)	3,543	■	■
CYFO	National Park Service – Big Horn Recreation Area	15,630	■	■
CYFO	U.S. Forest Service – Wood River Guard Station	39	■	■

Source: BLM2013a

[1]Withdwrawal and classification acreages provided in this table are not additive.
[2]Withdrawals for cave and karst areas that overlap the Spanish Point Karst ACEC are counted in both locations.

ACEC Area of Critical Environmental Concern
BLM Bureau of Land Management
BOR Bureau of Reclamation
CYFO Cody Field Office
FERC Federal Energy Regulatory Commission
WFO Worland Field Office

Two public land orders (Public Land Order 7396 on July 6, 1999, and Public Land Order 7370 on November 5, 1998) restored approximately 153,762 acres of previously withdrawn BOR land to BLM jurisdiction.

Land classification is a process required under specific laws to determine the suitability of public lands for certain types of disposal or lease, or suitability for retention and multiple use management. Most land classifications also segregate public lands from operation of some or all of the public land laws and/or mineral laws. Table 3-44 identifies existing site-specific classifications. Pending classifications associated with a proposal/application include 2 R&PPs and 13 DLEs which are under consideration for classification. Lands proposed to be leased or conveyed under the R&PP Act must first be classified as suitable for such use.

The 1964 Classification and Multiple Use Act established several existing classifications. The lands were classified for retention and multiple use management, and against sale, agricultural entry, and mining location, but they remain open to mineral leasing. In the Little Mountain area, approximately 2,800 acres are still included in this group of classifications.

Other segregations result from a variety of actions, such as exchanges and land sales in which the federal mineral rights are reserved to the United States in the land patent.

Management Challenges

There are a variety of management challenges for the lands and realty program in the Planning Area. These are based on historic activities and trends and current and future needs of public resources and internal and external customers. Most management challenges for lands and realty are related to balancing land tenure adjustments and land use authorizations between the maintenance of BLM resource objectives and the needs and desires of the public and other federal agencies.

Resolving trespass, dumping, and illegal use issues on public land is an important management challenge for the lands and realty program. There also are management challenges related to land tenure adjustments and the availability of lands and realty and other BLM personnel. The BLM has not fully surveyed many parcels identified for disposal and is uncertain of the condition of resources in these lands. Inventories of lands listed for disposal might identify unique resources, which could cause the BLM to reconsider these lands for disposal. Inventories of disposal lands and their resources also could increase public interest in land exchanges that would benefit both parties. Land exchanges present their own set of challenges because exchanges require a commitment of resources in both personnel and operating costs. Land exchanges, and potentially any land tenure adjustment, can be issues in relation to the value and appraisals attributed to the land and the equity of the land exchange. Interest groups and the general public are vested in the use of public lands, and the lands and realty program faces internal and external challenges to implement equitable land tenure adjustments that are in the public's interest.

Timely processing of permits (e.g., filming permits) and leases is a challenge for the lands and realty program. Local filming commissions compete intensively to bring these projects to the Planning Area, where the projects help support short-term economic activity. If the BLM cannot quickly process filming and other permits and leases, applicants often pursue other locations that would not benefit economies in the Planning Area.

3.6.2 Renewable Energy

Solar, wind, biomass, geothermal, and hydroelectric power are considered renewable energy resources. Wind energy produces electrical energy through the use of large wind turbines. Solar power refers to energy from the sun that is converted into thermal or electrical energy. Geothermal energy is derived from the heat stored in the interior of Earth. Biomass energy is the burning or use of organic materials as a source of energy. Hydroelectric power refers to the production of electrical power through the use of falling or flowing water. Wind, solar, biomass, and hydroelectric facilities are processed through the lands and realty program and authorized under Title V of FLPMA as ROW actions. Geothermal actions are considered a fluid leasable mineral and the BLM processes those actions according to the provisions of the Mineral Leasing Act.

BLM policy is to encourage the development of renewable energy in acceptable areas. In addition, Executive Order 13212 instructs the BLM "to expedite projects that will increase the production, transmission, or conservation of energy." As demand has increased for clean and viable energy to power the Nation, consideration of renewable energy sources on BLM-administered land has become a necessary component of land management planning.

In March 2009, the Secretary of the Interior issued a secretarial order making the production, development, and delivery of renewable energy on public land a top priority for the DOI. In addition to making renewable energy production a top priority for the department, the secretarial order established an energy and climate change task force with the goal of furthering the renewable energy agenda and identifying specific zones on public lands where the DOI can facilitate a rapid and responsible move to large-scale production of solar, wind, geothermal, and biomass energy.

In cooperation with the U.S. Department of Energy National Renewable Energy Laboratory (NREL), the BLM assessed renewable energy resources on BLM-administered land in the western United States, including Wyoming (BLM and DOE 2003). The BLM reviewed the potential for concentrated solar power, photovoltaic, wind, biomass, and geothermal energy on DOI, Bureau of Indian Affairs, and USFS lands in the West. Additional programmatic-level documents for wind, geothermal, and solar energy (the draft solar Programmatic EIS is under development) describe development potential, policies, and BMPs for renewable energy resources on public lands. Development of renewable energy resources on public lands follows policy and BMPs identified in these Programmatic EISs and other resource-specific policy and guidance.

Based on current policy direction and advances in technology, there is potential for renewable energy development in the Planning Area during the life of this RMP. The following paragraphs discuss resource potential and the affected environment for all types of renewable energy resources in the Planning Area. Wind energy has the greatest potential for development in the Planning Area and is discussed in more detail than other renewable resources. Additional details pertaining to wind-energy development are contained within the RFD.

Wind Energy

In 2005, the BLM completed a Programmatic EIS for a Wind Energy Development Program for the western United States (BLM 2005a). The ROD for this Programmatic EIS amended the current RMPs in the Planning Area by implementing programmatic policies and BMPs for wind-energy development in the Planning Area. IM 2009-043 (BLM 2008g) provides additional guidance for wind-energy development on BLM-administered land. The BLM issues ROWs for wind-energy projects for specific sites for meteorological towers, sites for meteorological towers and a project area (for the purpose of

excluding other wind energy ROWs while site testing and monitoring is being completed), and for full wind-energy development.

The BLM Wind Energy Programmatic EIS determined which areas on BLM-administered lands have high (Classes 4 to 7), medium (Class 3), or low (Classes 1 and 2) potential for wind-energy development based on their wind power classifications (BLM 2005a). The BLM uses NREL wind power classifications to identify wind resource potential based on wind power density at 50 meters above ground level. Class 4 to 7 wind resources are generally considered to be economically developable with current technology. Class 3 wind resources are expected to become more economical when low-wind-speed turbines, which are currently in development, become available. In some areas, a Class 3 wind resource could be economical using existing technology, depending on project-specific financing and incentives (BLM 2005a). Wind resource potential in the Planning Area varies from poor to superb (Table 3-45).

Table 3-45. Wind-energy Potential by Wind Power Class in the Planning Area

Wind Power Class	Resource Potential	Wind Speed (miles per hour)	Acres in Planning Area (BLM-Administered Acres)	Percent of Planning Area (Percent of BLM-Administered Lands)
1	Poor	0 to 12.5	3,296,107 (2,090,388)	58 (66)
2	Marginal	12.5 to 14.3	157,760 (793,995)	3 (25)
3	Fair	14.3 to 15.7	506,527 (209,481)	9 (7)
4	Good	15.7 to 16.8	147,001 (47,543)	3 (1)
5	Excellent	16.8 to 17.9	55,201 (17,788)	1 (1)
6	Outstanding	17.9 to 19.7	38,320 (13,516)	1 (Less than 1)
7	Superb	Greater than 19.7	24,100 (15,103)	Less than 1 (Less than 1)

Source: BLM 2005a

Note: The National Renewable Energy Laboratory has validated the estimates; however, the numbers are just estimates and should be confirmed by direct measurement.

In addition to wind power classifications, other factors influence the potential for wind-energy development in the Planning Area. Proximity to transmission lines to transfer energy produced at wind-energy sites influence the potential for wind-energy facilities. Adverse impacts to other resources and resource programs also affect the potential for wind-energy development in the Planning Area. Large wind turbines affect the visual landscape and can be considered a visual intrusion. Another key factor affecting wind-energy development potential in the Planning Area is the presence of special designations (e.g., ACECs and National Historic and Scenic Trails and WSAs) that are excluded from wind-energy development through the Wind Energy Programmatic EIS (BLM 2005a).

There are concentrated areas of medium (Class 3) to high (Class 4 through 7) wind potential in the south, southwest, and southeast portions of the Planning Area (Map 56). There are other areas of medium to high wind potential in the northern portion of the Planning Area around Cody along the Absaroka Mountain Front and McCullough Peaks area. The Absaroka Mountain Front area is close to major transmission lines that could be used to distribute wind energy.

Applications for ROW grants may be submitted for one of the following types of wind-energy projects:

- Site-specific wind energy site testing and monitoring ROW grant for individual meteorological towers and instrumentation facilities with a term limited to 3 years.
- Wind energy site testing and monitoring ROW grant for a larger project area, with a term of 3 years that may be renewed, consistent with 43 CFR 2807.22 and the provisions of IM 2006-216 (BLM 2006b) beyond the initial 3-year term.
- Long-term commercial wind-energy development ROW grant with a term not limited by the regulations but usually in the range of 30 to 35 years.

There are no current or pending ROW authorizations for wind energy facilities in the Planning Area. If meteorological data confirm wind resource potential along the Absaroka Mountain Front, this area could be a viable site for wind-energy development because there is major transmission infrastructure nearby. Given the current policy direction for renewable energy and the wind resources present in the Planning Area, it is likely that there will be wind-energy development during the life of this RMP. However, the BLM does not anticipate widespread wind-energy development in the Planning Area.

Solar Resources

The BLM currently processes solar energy ROW applications for lands under its Solar Energy Development Policy in IM No. 2007-097 (BLM 2007d). The U.S. Department of Energy, Energy Efficiency and Renewable Energy Program, and the BLM are preparing a Solar Energy Development Programmatic EIS to assess environmental impacts associated with development and implementation of agency-specific programs that would facilitate environmentally responsible utility-scale solar energy development on public land in six western states (Arizona, California, Colorado, New Mexico, Nevada, and Utah). The Solar Energy Development Programmatic EIS does not include Wyoming. However, the BLM would likely apply policy direction, BMPs, mitigation, and other management to solar energy projects in Wyoming.

There are no solar facilities or pending applications for solar facilities in the Planning Area. Based on the findings of the BLM Renewable Resource Assessment Project (BLM and DOE 2003), there are no locations in the Planning Area that receive six or more kilowatt hours per square meter per day of solar insolation. As a result, the potential for development of solar resources in the Planning Area is not likely.

Biomass Energy

Biomass power is obtained from the energy in plants and plant-derived materials, such as food crops and grassy and woody plants, residues from agriculture or forestry, and the organic component of municipal and industrial wastes. Biomass can be used for direct heating (e.g., burning wood in a fireplace or wood stove) and for generating electricity, or it can be converted directly into liquid fuels to meet transportation energy needs.

There are no biomass facilities and no pending applications for biomass facilities in the Planning Area. The potential for biomass energy facilities in the Planning Area is low because of low precipitation, a short growing season, allocation of grasslands resources to livestock grazing, and minimal availability of commercial forestland.

Hydroelectric

Hydroelectric power is generated through use of the gravitational force of falling or flowing water. Hydroelectric power is one of the most widespread forms of renewable energy throughout the world; however, its application is limited to the presence of flowing waterbodies of sufficient size to support economically viable development. Management of riparian and aquatic resources present additional constraints on hydroelectric development. There is no specific policy guidance or direction for the development of hydroelectric facilities on BLM-administered land as a renewable energy resource.

The BOR operates the Buffalo Bill Dam and Reservoir in the Planning Area near Cody. The dam produces hydroelectric power that is transmitted into a Western Area Power Administration transmission line. The BOR also operates Yellowtail Dam and Reservoir on the Wyoming-Montana border, which produces hydroelectric power.

New major hydroelectric power sources in the Planning Area would require construction of a new dam and reservoir, which is not likely because the only suitable site in the Bighorn Basin is in Clarks Fork Canyon. A dam and reservoir in this location could affect the WSR section of the Clarks Fork of the Yellowstone River north of Cody. There are no other known localities for major hydroelectric power production in the Planning Area.

The BLM has not received applications for hydroelectric power authorizations in the Planning Area on BLM-administered land, and it is not likely that any additional hydroelectric facilities would be developed in the future. However, there could be a need for new electrical transmission lines that serve hydroelectric turbines on non BLM-administered land.

Geothermal Energy

Geothermal resources are typically underground reservoirs of hot water or steam beneath the surface of Earth. Geothermal energy is produced when this steam or heat is used to turn a turbine to create electrical energy. Geothermal steam and hot water naturally discharge at Earth's surface in the form of hot springs, geysers, mud pots, or steam vents. Geothermal resources also include subsurface areas of hot, dry rock.

The Final Programmatic EIS for Geothermal Leasing in the Western United States evaluates various alternatives for allocating lands as being closed or available for geothermal leasing and analyzes stipulations to protect sensitive resources. The ROD for the Geothermal Programmatic EIS (BLM and USFS 2008a) amended existing plans to facilitate geothermal leasing on federal mineral estate in the Planning Area. The ROD for the Geothermal Programmatic EIS allocates acreages as open and closed, as listed in Table 3-46.

Table 3-46. Acres of Federal Mineral Estate Allocated as Open and Closed in the Record of Decision for Geothermal Leasing in Western States

Field Office	Land Use Plan Amended	Acres Open to Geothermal Leasing	Acres Closed to Geothermal Leasing
Cody	Cody RMP	722,834	39,317
Worland	Grass Creek RMP Washakie RMP	1,537,942	91,803

Source: BLM and USFS 2008b

RMP Resource Management Plan

Although geothermal resources are present throughout the Bighorn Basin, there are no active or pending federal geothermal leases in the Planning Area.

According to the Geothermal Programmatic EIS, there is potential in the Bighorn Basin for geothermal resource development; however, this potential is likely low to moderate because of the quality of geothermal resources and the backlog of geothermal resource development in other western states (BLM and USFS 2008a). Policy direction, advances in technology, and increased interest in renewable energy resources could lead to minimal geothermal resource development in the Planning Area during the life of this RMP.

For more information on geothermal resources, see Section 3.2.4 *Leasable Minerals – Geothermal* in this RMP and EIS and the *Reasonable Foreseeable Development Scenario for Geothermal, Bighorn Basin Planning Area* (BLM 2009h).

Management Challenges

One of the most notable management challenges associated with renewable energy resources is the ability to transmit power generated by renewable energy sources to the grid and to deliver it to the load centers where the energy is needed. Capacity to transmit new power out of the Planning Area appears to be limited unless existing lines are upgraded or new transmission lines built. Like wind turbines, power transmission lines include vertical structures, but also introduce a linear feature that can be particularly noticeable on a visual horizon on certain landscapes. Adverse impacts to other resources and resource uses caused by the development of renewable energy facilities can create additional management challenges.

3.6.3 Rights-of-Way and Corridors

Section 501 of FLPMA authorizes the BLM to grant ROWs for infrastructure and facilities that are in the public interest and require ROWs over, under, upon, or through BLM-administered lands. The BLM ROW program consists of the evaluation, authorization, and management of ROWs, including corridors, for a variety of uses on public/federal land. A ROW grant is an authorization to use specific pieces of public land for certain types of projects, such as developing roads, pipelines, transmission lines, and communications sites. A grant authorizes rights and privileges for a specific use of the land for a specific period.

In the existing plans, ROW corridors were formally designated as the preferred location for existing and future ROWs in the Planning Area. Land uses that typically do not require ROWs are those defined as “casual use” (43 CFR 3809.5). Casual use activities involve practices that do not ordinarily cause any appreciable disturbance to BLM-administered lands, resources, or existing improvements.

An important component of the ROW program is the intrastate and interstate transportation of commodities ultimately delivered as utility services (e.g., natural gas and electricity) to residential and commercial customers. Equally important at the local level is the growing demand for legal access to private homes and ranches using ROW grants. While most existing ROW actions in the Planning Area are for linear facilities, there also are many existing site ROWs for non-linear communications sites, water reservoirs, and energy resource distribution and transmission.

The BLM and other agencies (U.S. Department of Energy Office of Electricity Delivery and Energy Reliability and the USFS) prepared the Programmatic EIS for the Designation of Energy Corridors on Federal Land in Eleven Western States (DOE and BLM 2008b). The Programmatic EIS evaluates potential impacts associated with the proposed action to designate corridors on federal land in 11 western states

(including Wyoming) for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities. The ROD for the Programmatic EIS amended current RMPs in both the CYFO and WFO by designating energy corridor 79-216 as a multi-modal energy corridor (Map 63). Energy corridor 79-216 is the preferred location for major transmission and linear energy infrastructure in the Planning Area. This corridor contains several existing pipelines that go from the southern boundary of the Planning Area to the Montana border.

Existing ROW corridors are the preferred location for minor ROW grants (Map 63). These routes or areas are located primarily along existing highways, major pipelines and powerlines, oil fields, and communication sites. Concentrating new ROW grants along existing corridors works well when the source and terminus are nearby or when land along the route is predominantly on federal land. Due to the large blocks of public land and the various locations requested for the applications received, it is not always possible to concentrate new grants into designated corridors.

The use of ROW corridors in the Planning Area has been moderate, and existing corridors designated for major ROWs have been sufficient to meet demand and the needs of public land users. ROWs on BLM-administered lands in the Planning Area have primarily supported the development of energy minerals (i.e., project access roads, gathering/transportation pipeline systems, and related oil and gas facilities). However, in recent years, access roads and utilities associated with development of private lands have become more common.

Communications sites are authorized by a ROW under Section 501 of FLPMA and administered under regulations at 43 CFR 2800. Communications sites are typically site ROWs, which consist of facilities such as small buildings, towers, antennas, and other structures. The Planning Area contains a total of 72 communications sites concentrated in seven areas (Map 63). Communications site concentration areas are typically on mountaintops, ridgelines, or other high-elevation areas to allow uninterrupted transmission of the associated communications signal. Communications site plans have been prepared for each of the communications site concentration areas identified on Map 63. These plans govern specific development and management of communications sites in the area. Regularly updated information on communications site facilities, concentration areas, links to site plans, and other information for communications sites in the Planning Area can be found though the BLM website at: http://www.blm.gov/commsites/.

There are 2,192 existing ROWs (see Table 3-47) in the Planning Area covering approximately 44,539 acres. Most ROW applications in the Planning Area are for the development of powerlines, transportation and delivery of mineral-related commodities and facilities, telephone facilities (including fiber optic lines and communications sites), access roads, and water-related facilities (pipelines, ditches and canals, reservoirs). Over the last 10 years, the BLM has processed between 45 and 60 new or amended ROW applications every year for the Planning Area.

Table 3-47. Existing Rights-of-Way in the Planning Area

Existing Authorization	Number of Sites	Acres
Linear Rights-of-Way	2,108	43,659
Site Rights-of-Way	84	880
Total	**2,192**	**44,539**

Source: BLM 2009a

In the past 10 years, regional demand for ROWs on public land in Wyoming has increased; however, ROW demand in the Planning Area has remained relatively stable (BLM 2009a). Much of the regional demand has focused on exporting energy products through and from the sparsely populated western states to population centers, most recently dominated by west coast power demands. The upsurge in exploration and development of cleaner-burning fuels, such as natural gas, CBNG, and renewable energy resources, has resulted in the need for more pipelines and transmission lines. Technological advancements have also resulted in new demands on public land, largely related to wind energy and telecommunications (such as cellular and fiber optic). ROW applications in the region are likely to continue a slight upward trend during the planning cycle, while ROW demand in the Planning Area is expected to remain relatively stable.

If the current rate of development continues and current management remains in place, designated ROW corridors should adequately meet future needs over the next 10 to 20 years. At this rate of development, corridors could eventually be more intensively used, but the BLM does not anticipate crowding.

Oil and gas production in the Planning Area is expected to continue to come mostly from established fields that already have adequate infrastructure such as roads, powerlines, and gathering/transmission lines. Produced oil volume is flat or declining from these fields, and gas volume is stable or increasing. Therefore, no major increase in the number of new ROWs for oil and gas infrastructure (each field office currently issues 4 to 8 per year) is anticipated for the next 10 to 15 years unless there is more activity, such as the construction of a pipeline to bring CO_2 gas for use in oil recovery in existing oilfields.

The BLM estimates that demand for public land for access roads and electric or pipeline ROWs in the Planning Area will remain moderate over the next 10 to 20 years, depending on the location of energy mineral development (Williams 2011). A small increase in demand for public land for major energy transportation ROWs is expected, potentially involving one or two major projects every 10 years. Further development of renewable energy resources, specifically wind in Wyoming, could create additional need for ROWs for transmission lines in the region and through the Planning Area to deliver energy produced in Wyoming to other markets.

With the current market demand, the BLM expects the demand for communications sites on BLM-administered land to continue in the foreseeable future. Future need for additional fiber optic lines is not known; however, because these types of development tend to run between population centers, existing ROW corridors appear to be sufficient to meet future needs.

Management Challenges

In general, ROW management challenges include meeting national and regional demands for energy, infrastructure, telecommunications, and other services while balancing management objectives for other resources (e.g., the preservation of sagebrush habitat).

A specific management challenge associated with linear ROWs is the proliferation of unauthorized roads and trails caused by the general public driving along the ROWs. This unauthorized development can cause extensive damage to resources that often goes unmitigated.

3.6.4 Comprehensive Travel and Transportation Management

There are two fundamental and interrelated tasks associated with CTTM – (1) the delineation of travel management areas and (2) the delineation of OHV management areas, which designates travel management (as open, limited, or closed).

The transportation network on the public lands in the Bighorn Basin consists of federal and state highways, county roads, and roads built to facilitate industrial and commercial development. There is also an extensive network of official BLM roads that range from regularly maintained ditched and crowned gravel roads to an extensive array of unofficial roads and vehicle routes that were never formally constructed and rarely receive maintenance. Many are two-track vehicle trails created and maintained simply by the passage of motor vehicles. The network of two-track roads and trails is important for recreational and ranching uses on public lands.

Motorized Vehicle Use in the Planning Area

For purposes of this RMP and EIS, motorized vehicle use refers to the use of motor vehicles (e.g., all-terrain vehicles) off the main highway network in the Planning Area. The road and trail network in the Planning Area provides access for private, commercial, and industrial vehicles. Motor vehicle use supports many other resource uses, including livestock grazing, mineral exploration and development, communications, administrative activities, and recreation. Numerous types of motor vehicles are used on BLM-administered lands in the Planning Area, including large trucks, four-wheel drive vehicles, automobiles, motorcycles, and all-terrain vehicles.

Motorized vehicle use in the Planning Area has local, regional, and national significance, and has increased over the last 10 years. Recreation enthusiasts are buying OHVs at a rate of approximately 1,500 units per day nationwide (BLM 2001a). The use of these motorized vehicles is linked to a variety of recreation activities, including dispersed camping, hunting, and fishing, and they have become a popular form of recreation in the Planning Area. The McCullough Peaks area, Little Mountain, the west slope of the Big Horn Mountains, and Carter Mountain are popular areas for OHV use, especially during hunting season. In addition, OHVs have become tools for resource-related industries, including ranching, mineral exploration, and oil and gas production. Due to increases in the price of gasoline, there has been an increasing trend in the use of OHVs for recreational activities and common transportation.

The use of OHVs is expected to continue to grow, increasing the demand for specialized trails and areas available to motorized vehicle use (BLM 2001a). Areas between Basin and Greybull, outside of Lovell, and the Red Lakes area south of Cody, Wyoming, are experiencing an increase in off-road motorized vehicle use, even though this activity violates current motorized vehicle use management prescriptions for these areas.

Off-Highway Vehicle Management Areas

All public lands are required to have motorized vehicle use designations (43 CFR 8342). Accordingly, all lands are to be designated as open, limited, or closed to motorized vehicle use (Map 69). Lands designated as open are open to all motor vehicle use, on or off established roads and vehicle routes, as long as this activity does not cause unacceptable levels of resource damage. Limited means OHV use is restricted to designated roads and trails, and where an area is restricted, at certain times, in certain areas, and/or to certain vehicle uses. These restrictions can be of any type, but generally can be accommodated within the following categories: number of vehicles; types of vehicles; time of season of vehicle use; permitted or licensed use only; use on existing roads and trails (limited to existing roads and trails); and use on designated roads and trails (limited to designated roads and trails). Existing roads and trails are to be used as an interim designation until a Travel Management Plan designates each individual route as open or closed for motorized use (BLM Handbook 8342-1). Closed means the area is closed to all motor vehicle access, with the authorized officer granting exceptions for emergencies,

firefighting, public safety, or related incidents. A closed designation usually does not exclude foot or horseback travel or mechanized (such as mountain bikes) travel, and can be implemented to protect back country recreational setting opportunities or sensitive wildlife habitat.

The BLM manages some areas in the Planning Area specifically for nonmotorized vehicle use. Areas with trails open only to foot traffic include interpretive areas such as the Red Gulch Dinosaur Tracksite, Gooseberry Interpretive Trail, and Legend Rock. Areas open only to foot travel and mechanized vehicle use include the Paint Rock Trail, Lone Tree Trail, Salt Lick Trail, Canyon Creek access trail, Gebo, Bobcat/Houlihan Trail, and Four Bear Trail. The BLM manages these areas to protect their natural resources, provide for semi-primitive recreation opportunities, and provide for public health and safety.

Open to Motorized Vehicle Use

Approximately 1,311 acres in the Planning Area are open to motorized vehicle use. These locations include an area south of Cody, an area southeast of Lovell, an area northeast of Lovell, areas near Powell, and an area west of Worland. Several of the areas have been used for many years and continue to be used for this type of activity, even though there has been no formal implementation of this travel designation. See Appendix R for a list of other areas open to motorized vehicle use.

OHV groups, in coordination with the BLM, had previously adopted an area southeast of Worland called The Pits as a “play area” (an area open to motorized vehicle use where on- or off-route travel is almost unrestricted). However, after further monitoring and analysis, the BLM closed the area as a designated play area because of concerns about public health and safety related to H_2S from the oil and gas wells in the area. As a result, an area located west of Worland was allocated for open OHV use, but implementation plans have never been completed.

Other areas throughout the Bighorn Basin exist where off-road cross-country OHV use is observed, although the areas are not allocated to accommodate the use. In some areas, law enforcement has attempted to impede these activities, and in other areas, these areas are examined to determine whether or not they qualify (as per 43 CFR §8340.0-5, (f), (g) and (h) respectively) as open OHV areas.

Motorized Vehicle Use Limited

Motorized Vehicle Use Limited to Existing Roads and Trails

Motorized vehicle use is limited to existing roads and trails on approximately 2,315,896 acres in the Planning Area. The BLM created this designation to allow motorized vehicle use without increasing the number of acres disturbed by route creation. Recreational users are not authorized to travel off of roads and trails in these areas, except during the performance of necessary tasks such as the retrieval of game or for maintenance of range improvements and livestock management. Throughout the life of the current land use plans, OHV use in the Bighorn Basin has increased dramatically (BLM 2009a). Each year, new unauthorized pioneered routes and trails are being created by recreational users, casual use and necessary tasks in support of land use projects, and during observed spikes in OHV use, such as during hunting season. See Appendix R for a list of other areas where motorized vehicle use is limited to existing roads and trails. In recognition of the continual proliferation of pioneered routes in areas managed as "limited to existing roads and trails", recent BLM guidance changed "limited to existing roads and trails" from an OHV management allocation to an interim designation. The designation will change from “limited to existing roads and trails” to “limited to designated roads and trails upon the completion of a travel management plan” (BLM Handbook 8342-1).

Motorized Vehicle Use Limited to Designated Roads and Trails

Motorized vehicle use is limited to designated roads and trails on approximately 797,077 acres, primarily in environmentally sensitive areas, in the Planning Area. These areas include the west slope of the Big Horn Mountains (which includes the Little Mountain ACEC, West Slope Special Recreation Management Area (SRMA), Medicine Lodge and Renner Wildlife Habitat Management Units, Carter Public Access Area, and South Brokenback); the Upper Nowood area; the Bridger Mountains; the Red Canyon Creek area south of Thermopolis; Meeteetse Draw Rock Art area; the Sheep Mountain Anticline ACEC; the McCullough Peaks area; and the Absaroka Mountains which include the southern Absaroka Mountain foothills, Carter Mountain ACEC, the mountains along the North and South Forks of Shoshone River; Rattlesnake Mountain; and Bald Ridge. This designation has been successfully applied in a number of these locations. Travel management has been successfully implemented in the Grass Creek/Enos Creek area, Carter Mountain ACEC, Rattlesnake Mountain, McCullough Peaks, Little Mountain, Medicine Lodge and Renner Wildlife Habitat Management Areas, South Brokenback area, and the Upper Nowood. Such implementing strategies used to enforce travel management decisions include on the ground tools such as fences, regulatory signs, barricades, and enforcement, as well as through the assistance and cooperation of affected stakeholders. The off-road travel that does occur is infrequent, and the establishment of new two-tracks has remained minimal. Additional areas where motorized vehicle use is limited to designated roads and trails include essential and recovery habitat for threatened or endangered species, areas with fragile soils or with Class I or II VRM ratings, areas containing important cultural and paleontological resources, and areas over important caves or cave passages. See Appendix R for a list of other areas where motorized vehicle use is limited to designated roads and trails.

Seasonal and Over-Snow Closures

A number of locations in the Planning Area are generally limited to designated roads and trails, but also have a seasonal closure. During a portion of the year these areas are closed to motorized vehicle use. These seasonal restrictions are designed to protect the values of other resources, such as crucial wildlife winter range, and to protect fragile soils. Areas with seasonal closures include Carter Mountain, Medicine Lodge and Upper Renner WHMAs, Little Mountain Travel Management Area, Bald Ridge area, and Twin Creek Trail; the dates of these closures appear in Appendix R.

Areas closed to over-snow travel are generally decided on a case-by-case basis. However, some areas, such as Lynx Analysis Units, are designated as closed to this type of use to protect important habitat.

Closed to Motorized Vehicle Use

Approximately 68,115 acres in the Planning Area are closed to motorized vehicle use. Travel management designations in these areas are designed to protect resources from unnecessary damage, to sustain and manage for wilderness characteristics in the WSAs, and to protect recreationists from hazardous conditions. These areas include the Cody Archery Range; the Lovell Rod and Gun Club area; around the Duck Swamp-Bridger Trail Environmental Education area; surrounding the rifle range west of Worland; Sheep Mountain, Red Butte, Bobcat Draw Badlands, and the Owl Creek WSAs; the Spanish Point Karst ACEC; and along the Bighorn River south of Greybull, Wyoming, to protect threatened and endangered species habitat. See Appendix R for a list of other areas closed to motorized vehicle use.

Travel Management Areas

In order to manage the transportation system, the BLM addresses travel management by subdividing the field office into travel management areas that focus travel management planning efforts to maintain desired resource objectives, manage use and user conflicts, and protect public health and safety. Travel

management areas address acceptable modes of access and travel consistent with the designation criteria (43 CFR 8342.1). They also identify objectives for allowing travel in the area and setting characteristics to be maintained, including recreational settings for SRMAs. Travel management plans identify the appropriate network of roads and trails, including nonmotorized vehicle access, in travel management areas.

The BLM has implemented travel management plans for the McCullough Peaks; areas along the West Slope of the Bighorns including Little Mountain, South Brokenback, Medicine Lodge and Renner wildlife habitat areas, and the Upper Nowood area; and areas along the Absaroka Front including Grass Creek, Carter Mountain ACEC, and Rattlesnake. The BLM implements these plans through coordination with many stakeholders including, but not limited to local landowners, the WGFD, and the Wyoming State Trails program. Using the designation criteria as spelled out in 43 CFR 8342.1, travel management plans designate and develop travel routes as well as identify areas closed to motorized vehicle use in areas popular for big game hunting, hiking, camping, horseback riding, interpretive environmental education, and OHV use, and in crucial wildlife habitat areas. The areas for which travel management plans have been completed and implemented are areas where substantial motor vehicle use was identified as compromising the health and sustainability of the resources. The BLM established cooperative agreements with private land owners and other entities, including the WGFD and the Wyoming State Board of Land Commissioners, to manage motorized vehicle use in areas in the Absaroka foothills and the west slope of the Big Horn Mountains. Through the life of the existing RMPs, the WFO and CYFO implemented Off-Road Vehicle Designations for the McCullough Peaks (CYFO), Owl Creek, Bobcat Draw Badlands, Sheep Mountain, and Red Butte WSAs (WFO). The McCullough Peaks plan designated the primitive routes within the WSA, and the Grass Creek Resource Area's WSA travel management plan closed all primitive routes within the WSAs mentioned above to motorized use.

Motorized Vehicle Use and Environmental Concerns

In the Planning Area, the number and percent of lands open to cross-country motorized vehicle use is minimal and in areas where there are less likely to be sensitive resources or where potential conflicts can be mitigated (1,311 acres, or less than one percent of BLM-administered surface in the Planning Area). In addition to areas currently managed as open to cross-country motorized vehicle use, several new areas or expansions of existing areas are analyzed as part of this RMP revision project. Table 3-48 shows all areas proposed as open to cross-country motorized vehicle use currently or under any of the RMP alternatives, and any of a selection of key resource values each such area overlaps. Where overlaps between areas open to cross-country motorized vehicle use and these key resource values occurs. Table 3-48 describes why such use does not pose resource damage concerns or cause inherent conflicts. The percentage of lands closed to motor vehicle use is limited to areas, such as certain WSAs, where resource protection is paramount. Most of the Planning Area is available to motorized vehicle access on the designated or existing network of roads and trails (see Appendix R), and these areas include locations where motorized vehicle access and the protection of resources are important priorities.

Table 3-48. Overlap of Areas Open to Cross-Country Motorized Travel with Select Key Resource Values

Open Area	Acres	Wetland Riparian Areas (acres)	Greater Sage-Grouse Key Habitat Areas (acres)	Big Game Crucial Winter Range (acres)	Known Prehistoric or Historic Cultural Sites[2]	NHTs /Other Historic Trails (acres within 3 miles)[3]	Area Description
Hill Climbing areas near Cowley	118	0	0	0	No	0/0	This area is a de facto OHV hill climbing area. Motorcycle hill climbing events have been authorized in the past using Special Recreation Permits. Members of the public have used the area for many years for this purpose. The area is being mined for bentonite, and previous events were coordinated with the mining company. Once mining is completed, there may be an opportunity for hill climbing, depending upon land ownership and the terrain.
Hills area near Lovell (Bentonite Hills)	43	0	0	0	No	0/0	This area was identified in the Cody Resource Management Plan (BLM 1990) as an open area, but implementation never occurred. Motorized recreationists (using all-terrain vehicles and motorcycles) use the area for its technically challenging hill climbing opportunities. Nearly the entire area has been used for cross-country motorized travel.
Lovell Lakes Motocross Area	158	0	0	0	No	0/0	This area was identified in the Cody Resource Management Plan (BLM 1990) as an open area, but implementation never occurred.

Table 3-48. Overlap of Areas Open to Cross-Country Motorized Travel with Select Key Resource Values (Continued)

Open Area[1]	Acres	Wetland Riparian Areas (acres)	Greater Sage-Grouse Key Habitat Areas (acres)	Big Game Crucial Winter Range (acres)	Known Prehistoric or Historic Cultural Sites[2]	NHTs /Other Historic Trails (acres within 3 miles)[3]	Area Description
Red Lakes area near Cody	67	0	0	0	Yes	0/0	This area was identified previously as an open area, but implementation never occurred. This area is a de facto OHV play area where motorized recreationists (using all-terrain vehicles and motorcycles) use the area for its technically challenging hill climbing opportunities. Much of the area has been used for cross-country motorized travel.
Area near Park County Landfill	619	0	406	0	Yes	0/343	The open area is on the periphery of the Greater Sage-Grouse Key Habitat Area, where the habitat is marginal. This area is used by motorized recreationists (using all-terrain vehicles and motorcycles).
Basin Gardens Play Area	4,600	4	0	0	Yes	0/0	Wetland/riparian areas and known eligible historic properties could be mitigate through site specific implementation.
Rattlesnake Ridge	7,996	0	0	0	Yes	0/61	This area is a de facto OHV play area where motorized recreationists use the area for its technically challenging hill climbing opportunities. The area is also heavily used for oil and gas activities, a concern due to high levels of hydrogen sulfide gas. The area is currently managed as motorized use limited to existing roads and trails.

Table 3-48. Overlap of Areas Open to Cross-Country Motorized Travel with Select Key Resource Values (Continued)

Open Area[1]	Acres	Wetland Riparian Areas (acres)	Greater Sage-Grouse Key Habitat Areas (acres)	Big Game Crucial Winter Range (acres)	Known Prehistoric or Historic Cultural Sites[2]	NHTs /Other Historic Trails (acres within 3 miles)[3]	Area Description
Worland OHV Play Area	1,576	0	0	842	Yes	0/1,289	The Grass Creek Resource Area Resource Management Plan (BLM 1998a) designated about 900 acres as open for cross-country motorized travel, but implementation never occurred.

Sources: BLM 1998a; BLM 1990, BLM 2013a.

[1]Area, or portion of area, currently managed as open to motorized vehicles.
[2]Based upon existing available inventories and information. An inventory would precede the site-specific analysis for any plan to open these areas to cross-country motorized travel.
[3]Inventories and assessments have not occurred to determine where the contributing segments of these Other Historic Trails are located.

NHT National Historic Trail
OHV Off-highway vehicle

Environmental concerns associated with motorized vehicle use include a loss of soil and damage to vegetation due to surface disturbance, the creation of scars on hillsides, habitat loss, disturbance of wildlife in crucial habitats such as winter ranges, siltation of streams due to erosion from roads and trails, and degradation of scenic qualities and cultural sites.

Areas of concern in relation to actual and potential damage from motorized vehicle activity generally include highly erodible soils, riparian/wetland areas, crucial wildlife habitat (such as winter range), fragile soils and vegetation, scenic areas, WSAs, ACECs, cultural sites, and historic trails.

Management Challenges

Managing motorized vehicle use on public lands is one of the great challenges associated with public land management. This is not just a challenge unique to the Bighorn Basin or the state of Wyoming, but all over the United States. The BLM uses travel management designations, public information and education, and law enforcement as primary tools to manage motorized vehicle use on public lands.

Controlling the proliferation of unauthorized roads and trails is a challenge for the BLM CTTM program. Unauthorized road and trail proliferation damages scenic resources, disturbs vegetation and wildlife, and degrades wildlife habitats, the end result of which is that long-term resource values and uses are compromised.

3.6.5 Recreation

This section briefly describes the broad spectrum of recreational opportunities available on BLM-administered land in the Bighorn Basin.

Recreation Management

Recreational opportunities are offered to the public on all BLM-administered lands in the Planning Area to which there is legal access. Federal lands in the Planning Area provide a broad spectrum of outdoor opportunities that afford visitors the freedom of recreational choice with minimal regulatory constraints. The BLM provides opportunities for outdoor recreation and nature-based tourism using the concept of multiple-use management. Visitors to public lands are afforded the opportunity to enjoy natural landscapes, the freedom to choose a particular activity in which to participate, the opportunity to test skills in a sport, time spent with family and friends, and the opportunity for discovery. Recreational activities on public lands are multi-faceted.

There is dispersed recreation throughout the Planning Area in a wide range of recreational settings, and recreation can occur in combination with other resource activities. Dispersed recreation includes, but is not limited to, hunting, sightseeing, touring, backpacking, horseback riding, mountain biking, hiking, OHV use, spelunking, photography, wildlife viewing, fishing, boating and other water-related activities, and camping. The BLM offers some combination of these recreational opportunities to the public on all BLM-administered lands in the Bighorn Basin. Public access to BLM-administered lands is more readily available in the central and eastern portions of the Planning Area, in the basin and along the western slopes of the Big Horn Mountains, and less available in the southern Absaroka Foothills region.

In addition to managing dispersed recreation throughout the Planning Area, the CYFO and WFO recreation programs manage developed recreation sites ranging from minor improvements for parking to multi-site hosted campground areas. The BLM manages seven SRMAs (Map 75) and one National Back Country Byway (Map 90) in the Planning Area (refer to Section 3.7.2 *National Back Country Byways* for more information).

The BLM manages recreational uses on public lands to protect resources, reduce user conflicts, and promote public safety. Travel management designations are one of the ways this is accomplished. These designations have been implemented statewide and are designed to direct the appropriate use of motorized vehicles on BLM-administered lands.

The BLM uses law enforcement and routine monitoring of recreational uses and areas, along with information from the public, to identify issues related to recreation. The BLM addresses recreational issues through user education, signs, additional facilities, maintenance, and law enforcement attention.

The BLM has actively embraced the Leave No Trace and Tread Lightly programs in an effort to encourage responsible use of public lands. Both programs promote and teach outdoor ethics and are geared toward reducing the adverse impacts of recreation. The goal is to make recreational uses more sustainable in the long run.

Recent BLM guidance (IM No. 2006-060 and IM No. 2007-043) establishes the agency's commitment to incorporate the framework of benefits-based management (BBM) into its recreation management program. BBM is a method of managing recreation that focuses on the beneficial outcomes from engaging in recreational activities in areas managed for desired settings and experiences, rather than only on the recreation activities themselves. This approach gives the BLM a framework within which to manage recreation on public lands to provide outcomes that benefit individuals, communities, economies, and the environment (BLM 2009o). BBM represents a departure from previous recreation management methodologies by integrating management of recreation settings with desired recreation opportunities and benefits-through collaboration with public and local and private-sector providers. It is guided by the premise that the BLM is not a sole-source provider of recreation opportunities and that recreation planning must be considered in a regional context (BLM 2007e). Appendix O provides more information about BBM.

Special Recreation Permits

The field offices in the Planning Area have active SRP programs, administering over 80 SRPs per year for outfitters, activities, and events. Typical activities and events include outfitting and guiding for hunting, fishing, floating, horseback rides, wild horse viewing tours, interpretive tours, livestock drives, horseback fundraising events, horse endurance rides, yoga trips, motorcycle hill climbs, paragliding, triathlon events, mountain bike races, and wagon trains. The field offices collect between $11,000 and $14,000 per year in SRP fees and spend this revenue on visitor services, maintenance, monitoring, and law enforcement.

Outfit-guided hunting trips are the most popular SRP activity in the Bighorn Basin. Outfitters are widely dispersed over several hunt areas, and authorized activities take place during different times and places throughout the Planning Area. Conflicts between these SRP activities and other recreational uses are not uncommon and can result in visitor displacement.

Recreation Management Areas

The RMP planning process identifies areas where recreation is the management focus. SRMAs were traditionally areas that had higher recreation use or required extra recreation investment, or where more intensive recreation management was needed. When the Bighorn Basin planning revision was initiated, the 2005 revision of the BLM Land Use Planning Handbook (H-1601-1) amended the criteria for identifying an SRMA; these are administrative units where the predominant land use and emphasis is recreation. SRMAs provide specific long-term recreation opportunities (activities, experiences, benefits) and settings. SRMAs must identify a distinct, primary recreation-tourism market (destination, community, or undeveloped), and a corresponding and distinguishing strategy.

Since then, Washington Office Instruction Memorandum No. 2011-004 revised the guidance for Recreation and Visitor Services planning in conjunction with the BLM land use planning process. The major change establishes a three-tier classification for lands used and managed for recreation. This new

classification replaces the existing 30-year-old, two-tier system where all lands were classified as either special or extensive recreation management areas.

New guidance now defines RMAs as designated in a land use plan. The RMAs are classified as either SRMAs or extensive recreation management areas (ERMAs). The RMAs are land units where Recreation and Visitor Services (R&VS) objectives are recognized as a primary resource management consideration and specific management is required to protect the recreation opportunities. The RMA designation is based on: recreation demand and issues, recreation setting characteristics, resolving use/user conflicts, compatibility with other resource uses, and resource protection needs.

SRMAs are administrative units where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, and/or distinctiveness, especially as compared to other areas used for recreation. SRMAs are managed to protect and enhance a targeted set of activities, experiences, benefits, and desired recreation setting characteristics. Within SRMAs, R&VS management is recognized as the predominant LUP focus, where specific recreation opportunities and recreation setting characteristics are managed and protected on a long-term basis.

SRMAs may be subdivided into recreation management zones (RMZ) to further delineate specific recreation opportunities. The BLM Land Use Planning Handbook (H-1601-1) states that each RMZ has four defining characteristics – it (1) serves a different recreation niche within the primary recreation market, (2) produces a different set of recreation opportunities and facilitates the attainment of different experience and benefit outcomes (to individuals, households, communities, economies, and the environment), (3) has distinctive recreation setting character, and (4) requires a different set of recreation provider actions to meet the strategically targeted primary recreation market demand. At present, there are no designated RMZs in the Planning Area, but several are proposed as part of this RMP revision project.

SRMAs/RMZs must have measurable outcome-focused objectives. Supporting management actions and allowable use decisions are required to: 1) sustain or enhance recreation objectives, 2) protect the desired recreation setting characteristics, and 3) constrain uses, including non-compatible recreation activities that are detrimental to meeting recreation or other critical resource objectives (e.g., cultural or threatened and endangered species).

The Cody, Washakie, and Grass Creek RMPs identified seven areas to be managed as SRMAs (Map 75) based on the unique values and identified desired recreational settings, experiences, and beneficial outcomes. Chapter 2 describes current management for SRMAs and the proposed management for RMZs. The following paragraphs briefly describe existing SRMAs and proposed RMZs in relation to those SRMAs.

Absaroka Mountain Foothills SRMA – Goals and objectives for the 72,130-acre Absaroka Mountain Foothills are to enhance semi-primitive motorized and nonmotorized recreational opportunities in this scenic area.

Badlands SRMA – Goals and objectives for the approximately 213,981-acre Badlands SRMA are to provide for interpretive opportunities and to display the scenic qualities of the area. There are three RMZs proposed for the Badlands SRMA – Tour de Badlands, Wild Badlands, and Tatman Mountain.

Bighorn River SRMA – Goals and objectives for this approximately 15,256-acre SRMA are to provide for and enhance public access to the Bighorn River so as to enhance recreational opportunities and wildlife management. Recreational uses of public lands along the Bighorn River include fishing, hunting, and floating.

Historic Trails SRMA – This 12,065-acre SRMA includes segments of the Nez Perce NHT, Bridger Trail, and the Fort Washakie Trail to Red Lodge Stage Route.

The Rivers SRMA – This SRMA includes about 18,247 acres of public land along the Clarks Fork of the Yellowstone River, the north and south forks of the Shoshone River, and the main stem of the Shoshone River.

West Slope SRMA – The west slope of the Big Horn Mountains is popular for dispersed recreational activities due to scenic qualities; a variety of recreational resources, activities, opportunities, and experiences; access to the Bighorn National Forest, and accessibility in the area. The area provides recreation opportunities such as hunting, fishing, camping, hiking, backpacking, horseback riding, driving for pleasure, sightseeing, and spelunking. This SRMA contains several caves rated as significant. The West Slope SRMA is approximately 375,888 acres. There are four RMZs proposed in the West Slope SRMA − Trapper Creek, Paint Rock, Brokenback/Logging Road Area, and South Bighorns.

Worland Caves SRMA – The goals of this cave-focused SRMA are to provide protection for the fragile cave resources, promote ethical uses, and help educate the public on proper management and recreational use.

In addition, this RMP and EIS propose several new SRMAs (Red Canyon, Basin Garden, Horse Pasture, Rattlesnake Ridge, Newton Lake Ridge, Beck Lake, and McCullough Peaks).

ERMAs are administrative units that require specific management consideration in order to address recreation use, demand or R&VS program investments. ERMAs are managed to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA. Management of ERMAs are commensurate with the management of other resources and resource uses.

ERMAs must have measurable objectives. Supporting management actions and allowable use decisions must facilitate the visitors' ability to participate in outdoor recreation activities and protect the associated qualities and conditions. Non-compatible uses, including some recreation activities, may be restricted or constrained to achieve interdisciplinary objectives. In ERMAs, the BLM must identify management actions and allowable use decisions for R&VS and other programs to achieve ERMA objectives. In ERMAs, all decisions are compatible with other resource objectives. Within the R&VS Program, the BLM is to identify decisions necessary to facilitate visitor participation in the identified outdoor recreation activities; maintain particular recreation setting characteristics; address visitor health and safety, resource protection, and use and user conflicts (e.g., areas closed to target shooting, camping limits); and address the type(s), activities, and locations where special recreation permits would be issued or not issued. Within other programs, the BLM must establish terms, conditions, or special considerations for other resource programs necessary to achieve the ERMA objective (e.g., stipulations on mineral or other development, designations for all types and modes of travel, areas available for livestock grazing, or visual resource management classes). All actions must conform to applicable program policy, regulations and valid existing rights.

Several new ERMAs are proposed as part of this RMP revision project: Bighorn River ERMA, Absaroka Foothills ERMA, Rattlesnake Ridge ERMA, Red Canyon Creek ERMA, Southern Bighorns ERMA, and Basin Gardens ERMA.

Public lands that are not designated as RMAs are managed to meet basic R&VS and resource stewardship needs. Recreation is not emphasized however recreation activities may occur. The R&VS are managed to allow recreation uses that are not in conflict with the primary uses of these lands. Management actions and allowable use decisions may still be necessary to address basic R&VS and resource stewardship needs (visitor health and safety, use and user conflicts, the type(s), activities and

locations where special recreation permits would be issued or not issued, and mitigation of recreation impacts on cultural and natural resources).

The remaining BLM-administered public lands in the Bighorn Basin that are not identified as an RMA, which named under the old guidance, are the Cody ERMA (756,152 acres) and the Worland ERMA (1,566,022 acres). These areas do not have substantial numbers of developed recreational facilities such as campgrounds, nor does the BLM develop specific recreational setting prescriptions or recreation activity plans for these areas. The BLM provides custodial management of recreational activities in these areas to help ensure user health and safety, protect resources, and resolve use and user conflicts.

Recreational Use Patterns

Hunting and fishing are two of the most common recreational activities for local users on BLM-administered public lands in the Planning Area. Most pronghorn hunting, and a major portion of deer, elk, and upland bird (greater sage-grouse) hunting in the Planning Area occurs on public lands.

Hunting opportunities available in the Bighorn Basin also are available to non-residents. Commercial outfitting provides recreational opportunities for residents of other states, and the recreation and tourism industry is one of the most important industries in the Planning Area and the state of Wyoming as a whole.

Regionally, the Wyoming Travel Industry Impact Report of 2006 concluded that 7.3 million overnight visits to Wyoming resulted in $2.5 billion in direct travel-generated expenditures. The report also notes that 98 percent of visitors came to Wyoming for pleasure, while only 2 percent came for business. Travel and tourism resulted in $103 million in state and local tax revenues and $624 million in earnings for Wyoming residents (Wyoming State Office of Travel and Tourism 2007). The economic report of Wyoming Travel economic impacts for 2012 shows an increase of 5.4 percent since 1998 with 8.6 million visits in 2012 (Strategic Marketing & Research, Inc. 2012), contributing to $128 million in revenue, and $759 million in earnings, an 18 percent increase of overnight visits to Wyoming, a 24 percent increase in revenues, and 22 percent increase in earnings since 2006 (Wyoming Office of Tourism 2012). Refer to Section 3.8.2, *Economic Conditions* for more information.

A large proportion of outdoor recreation on public lands relates to hunting and fishing activities. The numbers of hunters and fishermen remain fairly constant over time because they depend on wildlife population numbers and available licenses. While there is no trend toward increased recreation related to hunting and fishing, the numbers do reflect the magnitude of recreation demand on public lands.

Table 3-49 lists hunting and fishing recreation days for Wyoming, BLM-administered lands in Wyoming, and public lands in the Planning Area from 2003 through 2011. The Planning Area estimates assume representative proportions of visitations in Wyoming and are based on a ratio of acreage in the Planning Area to acreage of land in Wyoming.

Table 3-49. Hunting and Fishing Recreation Days

Year	Wyoming	Bureau of Land Management (statewide)	Worland Field Office	Cody Field Office	Planning Area
2003	5,657,670	1,640,742	198,018	96,180	294,198
2004	3,626,301	1,051,627	126,921	61,647	188,568
2005	3,358,523	973,972	117,548	57,095	174,643
2006	3,458,582	1,002,989	121,050	58,796	179,846
2007	3,531,431	1,024,115	123,600	60,034	183,634
2008	3,683,371	1,068,178	128,918	62,617	191,535
2009	3,531,820	1,024,228	123,614	60,041	183,655
2010	3,665,862	1,063,100	128,305	62,320	190,625
2011	3,558,016	1,031,824	124,531	60,4186	185,017

Source: WGFD 2011a

Literature reviews show that recreation visitation trends in the United States fluctuate for a number of reasons, including drought, current social conditions, international conditions, current economic conditions and trends, and an increase in the costs for amenities such as fuel (Pergams and Zaradic 2006; Roggenbuck and Watson 1988).

Recreational use has generally been increasing in Wyoming, particularly in the northwest part of the state. Visitation data have been collected for Yellowstone National Park and Bighorn Canyon National Recreation Area, two national tourist attractions near the Planning Area. While visitation trends between 2002 and 2005 in both of these areas fluctuated, showing an overall decline in visitors, trends in both areas have shown a gradual increase since 2006 (NPS 2008). Based on current upward population trends in the state of Wyoming (Wyoming State Office of Travel and Tourism 2007) and the expansion of energy development in the state, it is likely that the general upward trend in outdoor recreation on public lands will continue for the foreseeable future (BLM 2009a).

There is a modest upward trend in overall public land recreational use in the Planning Area, though the degree of increase of this trend varies by activity. In 2006, 61 percent of recreational visits to Wyoming were to northwest Wyoming, which includes the Planning Area. Use of public land for some activities has remained stable, while use for other activities has increased. Locally, the BLM has seen increases in driving for pleasure, OHV use, fishing, hunting, camping, wildlife and wild horse viewing, and mountain biking. There has also been increased demand for SRPs on BLM-administered land in the Planning Area over the past 20 years.

Over the past 20 years, the BLM has seen a large increase in motorized recreation in relation to other forms of recreation. Part of this increase could be due to a shift in preferences and activities. For example, many hunters have shifted from more traditional foot or horseback travel to OHV travel.

If travel and transportation costs increase, the BLM would expect to see more Wyoming residents recreating on nearby public lands as a substitute for taking trips to more distant locations.

Management Challenges

Managing recreation and recreational resources to maintain the desired settings, experiences, and beneficial outcomes is a challenge when there are such a variety of conflicting uses. OHV recreation poses the most challenging activity in terms of maintaining and enhancing desired opportunities, experiences, and outcomes, as well as addressing the observable impacts OHV use can create. National, regional, and local OHV recreation has been trending upward for many years. The result is more demand for motorized vehicle trails and motorized vehicle use areas. The proliferation of unauthorized roads and trails continues. The BLM recreation program works to minimize resource damage, and use and user conflicts related to such activities. The BLM attempts to address these challenges by working and collaborating with local user groups and organizations, through formal travel management planning, promotion of educational efforts such as the tread lightly program, through resource monitoring, and through law enforcement activities.

3.6.6 Lands with Wilderness Characteristics

As mandated by FLPMA, Section 201, the BLM is to maintain an inventory of all resources, which include wilderness characteristics, and as mandated by FLPMA, Section 202, the BLM is to analyze management of all resources, including wilderness characteristics, in a Land Use Plan, which is reiterated in the BLM Land Use Planning Handbook (H-1601-1). Following the passage of Public Law 112-10, Section 1769 (2011 CR), which prohibit the appropriation of funds to implement, administer, or enforce the designation of lands with wilderness characteristic under Secretarial Order 3310, the BLM released IM 2011-154 clarifying the requirements of Section 201 and 202 of the FLPMA and providing guidance on the consideration of lands with wilderness characteristics in the planning process (BLM 2011f). Two BLM Manuals were released subsequent of the IM, BLM Manual 6310, Conducting Wilderness Characteristics Inventory on BLM Lands, and BLM Manual 6320, Considering Lands with Wilderness Characteristics in the BLM Land Use Planning Process. The criteria used to identify these lands originate from the Wilderness Act of 1964.

The inventory process utilized by the Cody and Worland Field Offices is consistent with the process for conducting inventories for lands with wilderness characteristics on BLM lands outlined in Manual 6310. Section 201 of FLPMA requires the BLM to maintain an inventory of all public lands and their resources. As specifically outlined in BLM Manual 6310, the lands with wilderness characteristics inventory included the following steps:

1) A boundary delineation process to define wilderness characteristic inventory unit boundaries, which can be based on existing wilderness characteristics inventory units. The boundary is generally based on the presence of wilderness inventory roads (a route analysis is conducted on all identified vehicle passageways to determine if the route is considered a road for wilderness inventory purposes), federal ownership boundaries, or developed right-of-ways.
2) An analysis of wilderness characteristics, including criteria for sufficient size, naturalness, and outstanding opportunities for either solitude or primitive and unconfined recreation. In addition, it may also possess supplemental values.
3) A boundary delineation process to define the area with wilderness characteristics to exclude wilderness inventory roads and other substantially noticeable human-caused impacts.

The BLM performed an inventory maintenance for all BLM-administered public lands within the Planning Area (see an example inventory form in Appendix S), including areas recommended as part of the "Wilderness at Risk: Citizens' Wilderness Proposal for Wyoming BLM-administered Lands" submitted to

the BLM by the Wyoming Wilderness Association in February 2004, 2011, and once again in 2012 (Wyoming Wilderness Coalition 2004, Wyoming Wilderness Coalition 2011, Wyoming Wilderness Coalition 2012). In addition, the Biodiversity Conservation Alliance submitted wilderness proposals in 2010 to the BLM. The wilderness proposals promoted the designation of approximately 1.1 million acres of BLM-administered lands for wilderness statewide, of which approximately 283,709 acres are in the Planning Area. During the inventory, BLM reviewed comments made during public scoping and recommendations developed during an internal review of multiple-use lands in the Planning Area, as well as incorporated wilderness data submitted by Environmental Resources Group (ERG), an environmental service company contracted out by the cooperators to assist in working on the RMP revision, Local Government Cooperating Agencies, and other local citizens. Consistent with WO IM 2013-106, these comments were integrated into the wilderness characteristics inventories and, as a result, some previously mapped lands with wilderness characteristic's boundaries were adjusted, and other areas previously believed to possess wilderness characteristics were dropped from the inventory after being found to lack those characteristics.

The original inventory identified 52 lands with wilderness characteristics (565,868 acres) in the Planning Area (Map 79). Table 3-50 lists the acreage and other resource values for each area. The final evaluation forms are available for public review at the WFO and the CYFO and on their respective websites. During the time between the Draft EIS, and the Final EIS, the BLM reevaluated data submitted from the public, resulting in 43 lands with wilderness characteristics (476,398 acres).

At present, the BLM manages lands with wilderness characteristics in accordance with the current RMPs. No specific management for retention of wilderness characteristics exists under the current RMPs. Current management for lands with wilderness characteristics appears in Table 3-51.

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
0008 DH	6,417	WY-010-220 Subunit B	6,417	Cultural Resources; Paleontological Resources; Special Status Species	Yes							Yes
0016 DH	6,186	WY-010-221 Subunit E	6,185	Paleontological Resources	Yes							Yes
0048 PR	7,107	WY-010-222 Subunit C	8,757	None identified	Yes							Yes
005 PR	8,014	WY-010-236 Sununit B	7,874	Cultural Resources; Special Status Species	Yes	Yes						Yes
069 JW	1,056	WY-010-213 Subunit A	1,056	Wildlife Resources; Scenic		Yes					Yes	Yes
130 JW	248	WY-010-218 Subunit A	248	Wildlife Resources; Scenic; Cultural Resources							Yes	Yes
1535 PR	17,458	WY-010-242 Subunit B	14,985	Cultural Resources		Yes						
1536 PR	10,685	WY-010-242 Subunit C	7,099	Cultural Resources								Yes
31 PR	2,972	WY-010-231 Subunit A	2,699	Cultural Resources							Yes	Yes

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
508 AK	4,035	WY-010-126 Subunit D	0	Scenic; Cultural Resources	Yes						Yes	Yes
508 TriState Gooseberry N Platte	13,464	WY-010-131 Subunit D	13,449	Wildlife Resources; Cultural Resources; Paleontological Resources; Topographic Features	Yes							Yes
509 AK	13,876	WY-010-130 Subunit B	0	Wild Horses; Wildlife Resources; Cultural Resources; Paleontological Resources	Yes				Yes			Yes
509 AK Dorsey Ck.	4,578	WY-010-131 Subunit F	0	Cultural Resources; Paleontological Resources	Yes		Yes				Yes	Yes
516 DH	553	WY-010-115 Subunit A	553	Wildlife Resources; Special Status Species; Recreation; Scenic					Yes		Yes	
568 TS	2,491	WY-010-102 Subunit A	2,492	Wildlife Resources; Special Status Species; Recreation; Scenic					Yes		Yes	

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
577 AK	7,107	WY-010-131 Subunit	0	Wildlife Resources; Paleontological Resources; Cultural Resources	Yes					Yes		Yes
622 AK	29,690	WY-010-124 Subunit A	0	Wildlife Resources; Scenic; Cultural Resources; Special Status Species	Yes					Yes		Yes
626 AK	10,280	WY-010-126 Subunit C	0	Scenic; Cultural Resources					Yes			Yes
639 AK	13,921	WY-010-130 Subunit D	13,916	Cultural Resources; Paleontological Resources	Yes			Yes	Yes			Yes
651 AK	6,410	WY-010-131 Subunit E	6,410	Cultural Resources; Paleontological Resources; Topographic Features; Wildlife Resources	Yes							Yes
652 Lower, Upper AK	21,153	WY-010-130 Subunit E	21,147	Paleontological Resources; Wild Horses; Wildlife Resources	Yes				Yes			

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
661 TS	743	WY-010-104 Subunit B	0	Wildlife Resources; Scenic; Cultural Resources					Yes		Yes	
665 CW	15,688	WY-010-111 Sununit A	11,200	Recreation; Scenic; Topographic Features	Yes					Yes		Yes
668 AK	3,435	WY-010-131 Subunit F	0	Cultural Resources; Paleontological Resources	Yes		Yes				Yes	Yes
669 AK	8,387	WY-010-130 Subunit C	8,386	Cultural Resources; Paleontological Resources; Wild Horses; Wildlife Resources	Yes							Yes
676 AK, PR	14,225	WY-010-126 Subunit E	14,225	Cultural Resources; Paleontological Resources; Wild Horses; Wildlife Resources	Yes			Yes				
Alkali Creek NW CP	4,444	WY-010-241 Subunit D	4,444	Cultural Resources		Yes			Yes		Yes	Yes

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
Bald Ridge	7,077	WY-020-001	4,920	Special Status Species; Wildlife Resources	Yes	Yes						Yes
Bobcat Draw South CP	4,200	WY-010-126 Subunit C	14,471	Scenic; Cultural Resources; Paleontological Resources	Yes						Yes	Yes
Bobcat Draw South II CP	7,567	WY-010-126 Subunit D	11,597	Scenic; Cultural Resources	Yes							
Bobcat Draw West CP	5,511	WY-010-126 Subunit B	5,457	Scenic; Cultural Resources	Yes			Yes		Yes		
Carter Mountain	14,496	WY-020-002	11,777	Special Status Species; Vegetation Resources			Yes		Yes			Yes
Cedar Ridge	6,364	WY-020-003	4,823	None identified	Yes		Yes		Yes			Yes
Coon Creek	30,769	WY-020-004	30,539	None identified	Yes							Yes
Crystal Creek	15,165	WY-020-005	12,807	Scenic; Public Access	Yes	Yes		Yes	Yes	Yes		Yes
Honeycombs 164 CP	1,157	WY-010-221 Subunit D	1,136	Paleontological Resources					Yes		Yes	Yes
Honeycombs NW 107 CP	2,026	WY-010-221 Subunit C	2,015	Cultural Resources; Paleontological Resources					Yes		Yes	Yes

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
Honeycombs South CP	34,487	WY-010-221 Subunit B	34,228	Cultural Resources; Paleontological Resources	Yes		Yes	Yes	Yes			Yes
Little Dry Creek	48,929	WY-020-006	42,866	Scenic	Yes				Yes	Yes		Yes
Medicine Lodge North CP – Subunit A	6,322	WY-010-240 Subunit C	6,188	Scenic; Cultural Resources								Yes
Medicine Lodge North CP – Subunit B	0	WY-010-240 Subunit B	1,132	Scenic; Cultural Resources								Yes
N. YU Bench	25,097	WY-020-007	22,108	Open Space	Yes		Yes			Yes		Yes
Owl Creek CP	7,423	WY-010-104 Subunit B	8,168	Scenic; Cultural Resources				Yes	Yes			Yes
Painted Hills	9,182	WY-020-008	7,892	None identified	Yes	Yes				Yes		Yes
Paintrock CP	8,809	WY-010-239 Subunit B	8,795	Scenic; Cultural Resources							Yes	
Rattlesnake Mountain	18,663	WY-020-009	0	Special Status Species	Yes	Yes		Yes	Yes	Yes		Yes
Red Butte North CP	11,777	WY-010-131 Subunit F	19,528	Cultural Resources	Yes		Yes					Yes
Rough Gulch	12,508	WY-020-010	12,188	Wild Horses	Yes				Yes	Yes		Yes
Sheep Mountain South CP	2,172	WY-010-130 Subunit B	16,042	Paleontological Resources							Yes	
Sheep Mountain	13,063	WY-020-011	12,527	Special Status Species; Wildlife Resources		Yes			Yes			Yes

Table 3-50. Lands with Wilderness Characteristics and Other Resource Values and Uses (Continued)

Lands with Wilderness Characteristics Area Name	Acres	2011 Inventory Number	2011 Inventory Acres	Supplemental Resource Values	Valid Existing Rights Present	Locatable Mineral Development Potential	Moderate Oil and Gas Development Potential	Scientifically-significant Fossil Potential	In Holdings and/or Access Issues	Existing ROW or ROW Corridor	Limited Manageability (insufficient size, configuration)	Proximity to Wildland Urban Interface
Trout Creek	4,514	WY-020-012	4,504	Fish and Wildlife Resources; Special Status Species							Yes	
Whistle Creek	37,727	WY-020-013	30,234	Wild Horses	Yes		Yes		Yes	Yes		Yes

Sources: BLM 2011a, BLM 2013a.

CP Citizens Proposed
ROW Rights-of-way

Table 3-51. Acreage of Current Management in Lands with Wilderness Characteristics

Minerals Management			Rights-of-Way			Visual Resources Management				Travel Management				
Withdrawn from Locatable Mineral Entry	*Mineral Materials Closure*	*Closed to Mineral Leasing*	*Exclusion*	*Avoidance/Mitigation*	*Open*	*Class I*	*Class II*	*Class III*	*Class IV*	*Closed*	*Limited to Designated Roads and Trails*	*Limited to Existing Roads and Trails*	*Open*	*Seasonal Restrictions*
21,428	14,355	33,603	12,902	116,045	347,402	< 6	106,900	90,371	278,969	5,714	145,392	325,236	0	17,725

Source: BLM 2013a

< less than

BLM Manual 6320 establishes the BLM's approach for considering lands with wilderness characteristics in land use planning documents (e.g., RMP revisions), and provides national guidance to the BLM on how to meet its obligation to identify and consider lands with wilderness characteristics. The guidance states that "The BLM will analyze the effects of (1) plan alternatives on lands with wilderness characteristics and (2) management of lands with wilderness characteristics on other resources and resource uses. The decision making process the BLM uses to evaluate lands with wilderness characteristics during the preparation of land use plans are the management alternatives (see Chapter 2 of this document for potential management actions for lands with wilderness characteristics in the Planning Area). Under Manual 6320, outcomes of this planning process may include "(1) emphasizing other multiple uses as a priority over protecting wilderness characteristics; (2) emphasizing other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics; (3) the protection of wilderness characteristics as a priority over other multiple uses."

In making lands with wilderness characteristics management decisions, BLM will consider, as outlined in Manual 6310, manageability, resource values and uses, and the congressional release of WSAs.

Table 3-50 provides information on other resource uses and values within each area with wilderness characteristics.

3.6.7 Livestock Grazing Management

Before 1934, the General Land Office managed grazing on public lands outside forest perimeters. Congress initiated comprehensive management of these lands in 1934 when it passed the Taylor Grazing Act. The Grazing Service was established and charged with implementing the provisions of the Act. Specific tasks included establishment of a permit system, organization of grazing districts, fee assessment, and consultation with local advisory boards.

In 1946, the Grazing Service and General Land Office merged to form the BLM. Until Congress passed the FLPMA in 1976, the Taylor Grazing Act was the principle legislation used to administer livestock grazing on public lands. In 1978, Congress passed the Public Rangelands Improvement Act, which established a grazing fee formula that sets and adjusts annual fees for grazing on public land.

In 1985, the BLM established three categories for grazing allotments to identify areas with the potential need for management, and to prioritize workloads and the use of range improvement dollars. The BLM categorized allotments as Improve Existing Resource Conditions (I), Maintain Existing Resource Conditions (M), or Custodial Management (C). Criteria the BLM used to place allotments in category I included the amount of public land in the allotment; the willingness of lessees to invest in management; opportunities for constructing range improvements; the existence of grazing-related resource conflicts; the allotment had moderate to high forage production potential and was producing at low to moderate levels; the rancher or the BLM identified opportunities for improvement in range condition; range trend was static or downward; livestock management could be improved through water distribution; seasons of use or other factors; and opportunities for a positive economic return on public investments. The *Glossary* defines the criteria for placing allotments into the three categories; Appendix P provides a complete list of allotments in each of the categories.

In August of 1995, the 43 CFR 4180 regulations were enacted that changed BLM methods and administrative procedures for managing public lands. These regulations directed the establishment and application of standards for healthy rangelands and guidelines for livestock grazing management to achieve the four fundamentals of rangeland health (43 CFR 4180.1). Those four fundamentals are (1)

watersheds are functioning properly; (2) water, nutrients, and energy are cycling properly; (3) water quality meets State standards; and (4) habitat for special status species is protected. The Secretary of the Interior approved *Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the BLM in the State of Wyoming* in 1997.

Cattle are the primary livestock grazers on public lands, but grazers also include sheep, domestic horses, and small numbers of bison. Goats and sheep are sometimes authorized for the purpose of suppressing weeds. The relative number of these grazing animals has varied in response to their economic value as a commodity and their use in ranching operations.

Animal Unit Month Allocations

All livestock grazing units in the Planning Area are classified as allotments. Livestock permits authorize grazing use based on perennial vegetation. Grazing preference is attached to base property owned or controlled by a permittee and has a priority position against others for the purpose of receiving a grazing permit. Base property in the Planning Area is land based.

At present, the BLM administers 687 grazing allotments covering 3.2 million acres in the Planning Area. Approximately 203 of these grazing allotments are located either completely or partially in lands with wilderness characteristics. Appendix P provides additional details about grazing allotments, including allotment number, allotment name, total federal acres, type of management, management category (M, I, or C), active use, and kind of livestock. Map 80 shows grazing allotments in the Planning Area. The *Glossary* provides detailed definitions related to livestock grazing management including, but not limited to, Active Use, Permitted Use, and Suspended Non-Use.

Permitted use is the amount of forage available for livestock grazing under a permit and is expressed in AUMs. Permitted use includes active use, suspended use, and temporary suspended use. Active use is the maximum amount of forage generally available in any given year under a permit. Due to fluctuating forage production, in any given year the BLM might authorize more or less forage for use for livestock grazing under a valid permit due to fluctuating forage production. The BLM determines stocking rates by monitoring the condition and amount of vegetation on a given site to ensure that adequate plant recovery time is provided and ample residual forage remains after livestock grazing to provide for healthy rangelands and other uses. Monitoring climate and water availability has resulted in forage availability adjustments, and by extension, adjustments to the numbers of livestock on the range. Predation also has resulted in changes in livestock type from sheep to cattle, and in some cases from cattle to horses. In other areas, disease-related concerns have resulted in the voluntary removal of domestic sheep in areas occupied by bighorn sheep.

Total active use for the Planning Area is 305,264 AUMs. The number of AUMs authorized annually in the Planning Area (Table 3-52) has remained fairly constant, but there has been a slight decline since 1989. This decline in authorized AUMs is due primarily to user requests for temporary non-use and unfavorable climatic conditions. For example, the gradual implementation of rest-rotation grazing systems leaves a portion of the allotment in non-use each year, contributing to the reduction. In addition, until 2009, which was a rare year of above-average rainfall, the Bighorn Basin had experienced drought conditions since 1999. The drought has resulted in less forage available for livestock use and the need for permittees/lessees to take voluntary non-use. During drought years, livestock operators and the BLM work closely to tailor the adjustments in livestock use to meet the needs of the land and ranching operations. In addition, annual fluctuations in authorized AUMs can develop from user demands, climatic conditions, and/or from the collection of monitoring information.

Grazing allotments typically include intermingled federal, state, and private lands that are managed as a unit. Ranches that lease federal rangelands obtain, on average, 28 percent of the total rangeland AUMs from federal lands, 3 percent of AUMs are from state lands, and the remaining 69 percent of rangeland AUMs from private lands, both leased and deeded (Gee et al. 1986a; Gee et al. 1986b). Based on this allocation, ranchers obtain an estimated 2.46 AUMs of rangeland grazing from other sources for every AUM of federal grazing land (Skold and Davis 1995).

Under certain scenarios, such as the relinquishment of grazing permit, the BLM may designate a unique type of grazing unit known as a reserve common allotment. Reserve common allotments may be used by grazing permittees who are temporarily unable to use their regular allotments for various reasons; for instance, to complete range improvements. These allotments would be created with ranchers cooperatively and voluntarily to promote healthier grazing lands. There are currently no reserve common allotments in the Planning Area.

Table 3-52. Billed Animal Unit Months

Year	Worland Field Office	Cody Field Office	Planning Area
1989	151,089	104,336	255,425
1990	161,473	104,287	265,760
1991	160,117	100,208	260,325
1992	154,932	95,090	250,022
1993	167,984	102,388	270,372
1994	168,116	101,782	269,898
1995	176,807	102,481	279,288
1996	183,454	98,301	281,755
1997	173,882	105,514	279,396
1998	175,665	98,773	274,438
1999	171,373	95,330	266,703
2000	148,738	84,531	233,269
2001	128,602	72,893	201,495
2002	96,255	58,686	154,941
2003	108,141	59,295	167,436
2004	121,010	50,130	171,140
2005	123,033	64,274	187,307
2006	133,754	67,828	201,582
2007	137,185	61,080	198,265
2008	129,937	39,031	168,968
2009	136,292	35,631	171,923
2010	137,513	33,912	171,425
2011	149,412	42,568	191,980
2012	144,516	37,987	182,503

Source: BLM Land and Resources Project Office 2013

Livestock grazing uses several resources directly and some resources indirectly. Livestock use rangeland vegetation for forage, but also might use riparian areas and wetlands for sources of water and forage. The BLM authorizes livestock grazing on specific allotments during different seasons. Grazing seasons vary with elevation and geographical change, resource needs, and user preference. Higher-elevation allotments are generally grazed during summer and fall. Lower-elevation allotments may be grazed during any season, but are generally used in fall, winter, and spring. Most of the allotments in the Planning Area are operating under grazing strategies that incorporate rest, seasonal rotations, deferment, and prescribed use levels that provide for adequate plant recovery time to enhance rangeland health. When rangelands are not meeting resource objectives due to current livestock grazing, the BLM implements changes in grazing management. It should be noted that possible deleterious resource uses on public lands (defined in this case as uses that prevent objectives from being met) are not limited to grazing. Policies and regulations provide BLM with direction for coordination, cooperation and consultation with permittees and interested publics regarding the collection, analyses, and reporting of monitoring information.

According to the USDA National Agricultural Statistics Service (NASS), in 2013, Wyoming accounted for 1.4 percent of the total number of cattle and calves within the United States. During 2013, Wyoming accounted for 7 percent of the total number of sheep and lambs in the United States. Nationally, as of 2012 Wyoming ranked second in wool production, second in total number of sheep and lambs, and twenty-third in total number of cattle and calves.

The Stock Raising Homestead Act of 1916 authorized and a Secretarial Order created stock driveways for the specific purpose of creating lanes and reserving water sources for trailing livestock. Stock driveway withdrawals prohibited disposal of these lands, protected water sources, and placed limits on mining activity.

Use of stock driveways was an important part of livestock operations, especially for ranchers driving livestock between summer and winter ranges across the Planning Area. At present, 92,932 acres of public lands are identified as being part of the stock driveway system (BLM 2013a). Approximately 170 miles of stock driveways have been withdrawn for livestock trailing in the Planning Area. Stock driveways in use include predominantly the W-T, Nowater, and Rome Hill Livestock Trails and the Rawhide Allotment (03098). There are more designated livestock trailing routes that do not incorporate land withdrawals. Annual trailing use is over 2,200 AUMs (BLM 2008a).

There are a number of methods livestock managers use to evaluate rangeland health that can reveal trends in the composition or productivity of a plant community. The BLM monitors rangelands throughout the Planning Area as part of the landscape health assessment process.

Overall rangeland trends in relation to livestock grazing are stable or improving. The BLM manages many allotments under grazing rotations and seasons of use designed to meet soil cover and desired plant species growth requirements. Observations of old headcuts, roads, and other disturbances show that perennial species have increased in these areas once disturbances ended. Generally, these observations have been confirmed in the rangeland health determinations completed to date. Where the BLM has identified existing livestock grazing or levels of use as a primary cause for rangeland health standards not being met, it has changed grazing use. The majority of allotments assessed to date meet, or are making progress towards meeting, the *Wyoming Standards for Healthy Rangelands*. Disturbances related to other ongoing resource uses (including oil and gas development and mining) can affect the observed trend.

Starting in 1998, the BLM began assessing grazing allotments for adherence to the approved *Wyoming Standards for Healthy Rangelands* (Appendix N) per the 1995 revision to the 43 CFR 4100 grazing

regulations, and making management decisions in accordance with these standards (Appendix N). The BLM offers grazing permits, and permittees accept them with the understanding that before reissuance, the BLM will evaluate resource conditions to determine if they conform to the standards for healthy rangelands approved by the Secretary of the Interior on August 12, 1997. The *Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the BLM in the State of Wyoming* allow sustainable livestock grazing management to continue while simultaneously protecting watersheds, riparian and upland ecosystems, and wildlife habitat. Standards address the health, productivity, and sustainability of BLM-administered public rangelands and represent the minimum acceptable conditions for public rangelands. The standards apply to all resource uses on public lands. The BLM will determine their application as use-specific guidelines are developed. Standards can be synonymous with goals and are observed on a landscape scale. They describe healthy rangelands rather than important rangeland byproducts. The achievement of a standard is determined by observing, measuring, and monitoring appropriate indicators. An indicator is a component of a system the characteristics of which (e.g., presence, absence, quantity, and distribution) can be observed, measured, or monitored based on sound scientific principles.

BLM specialists use Technical Reference 1734-6 version 4-2005, *Interpreting the Indicators of Rangeland Health*, to assist in making a determination for achievement of upland standards for healthy rangelands (Pellant et al. 2005). The BLM authorized officer is required to take appropriate action as soon as practical but not later than the start of the next grazing year upon determining that existing grazing management needs to be modified to ensure that the Fundamentals of Rangeland Health and Standards and Guidelines for Grazing Administration are either met or making significant progress towards achievement (CFR 4180.1). As discussed in Section 3.4.3, *Vegetation – Riparian/Wetland Resources*, the BLM currently manages all riparian/wetland areas to meet Proper functioning condition (PFC), which under certain circumstances, may require changes in grazing management.

From 1998 through the end of the 2010 fiscal year, the BLM had completed rangeland health evaluations for 308 allotments in the Planning Area (Appendix P). Of these, 168 allotments were found to meet or were making significant progress towards meeting *Wyoming Standards for Healthy Rangelands* 1, 2, 3, and 4. Allotments which had the Water Quality Standard of “unknown” are not considered as Not Meeting Standards. That status is a BLM policy unless the Wyoming DEQ provides specific information that waters in the allotment are not meeting state water quality standards. Including these allotments as “not meeting standards” would be misleading in terms of the current status of grazing allotments in the RMP. Allotment-specific guidelines are being implemented to improve rangeland conditions in areas that do not meet standards. In most allotments not meeting standards, not all public lands were considered to be failing. In addition, many not meeting standards determinations were for reasons other than current livestock management (e.g., historic livestock grazing use, OHV use, oil field development, and mineral extraction). Of allotments not meeting these standards, 20 were due to current permitted livestock grazing management and all 20 have had corrective actions taken. Where current livestock grazing management has been identified as contributing to an allotment failing rangeland health standards, the BLM uses the *Wyoming Guidelines for Livestock Grazing Management* to direct new grazing management stipulations for the allotment.

Range improvement projects and grazing systems, collectively known as BMPs, and allotment management plans (AMPs) have been used in range management since the early 1970s. There are many older range improvement projects on public lands that appear to have never been authorized by the BLM. These consist primarily of reservoirs and fences. It is possible some of these projects were authorized, but their records are not available. In recent years the BLM has cost shared with other agencies and private organizations on some projects to reach mutual goals or objectives.

The BLM Range Improvement Project System database lists range improvement projects completed in the Planning Area. Since the completion of the Cody, Grass Creek, and Washakie RMPs, the BLM has initiated approximately 423 projects and 82,314 acres of vegetation treatments in the Planning Area (Table 3-53). In addition, it has modified or reconstructed several older projects. Projects include vegetative manipulation treatment projects using prescribed fire, mechanical treatments, seeding, or chemical treatments to modify plant communities. The BLM also has constructed fences, water developments, spring enclosures, and cattleguards. Range improvements are planned and designed to enhance rangeland health and wildlife habitat and to mitigate conflicts with other uses. In several projects, the BLM has replaced or modified existing fences to make it easier for wildlife to pass.

Table 3-53. Type and Number of Range Improvement Projects in the Planning Area Since Completion of Previous Resource Management Plans

Type of Project	Number of Projects/Acres Completed
Fences	176 projects
Reservoirs	120 projects
Springs	35 projects
Wells	23 projects
Pipelines	69 projects
Brush Control	82,314 acres

Source: BLM Land and Resources Project Office 2013

Note: This table has not been updated to include a small number of range improvements installed in the Planning Area since the publication of the Draft RMP and Draft EIS.

Management Challenges

Management challenges for the livestock grazing management program include water supply and distribution, forage production, forage quality, and topography. Water availability can have an important effect on the ability of livestock to properly utilize the range. Distribution of water affects the ability of the livestock to efficiently use the forage available in the allotment. Well-distributed water sources equates to efficient use of the grazing pasture, reducing the number of areas that are grazed too intensely or not used at all. Range suitability is related to the distance to water, slope, season of use, and class and kind of livestock. Forage availability is also an important feature. Forage production affects the carrying capacity of the range for all uses and, more specifically, how many and how long livestock can remain on the range. The condition of the range affects forage quantity and quality. For example, a range dominated by appropriate cool-season bunchgrasses generally provides a better forage base than one dominated by invasive species. Surface-disturbing activities (e.g., mineral development) can reduce or change the status of forage in the Planning Area.

3.7 Special Designations and Other Management Areas

This section describes ACECs, National Back Country Byways, NHTs and Other Historic Trails, WSRs, and WSAs. Where data exists, these areas are depicted on maps 84-89, 90, 91-92, 94, and 93, respectively.

3.7.1 Areas of Critical Environmental Concern

Section 103(a) of the FLPMA defines an ACEC as an area within public lands where special management attention is required to protect and prevent irreparable damage to important historical, cultural, or scenic values; fish and wildlife; or other natural systems or processes, or to protect life and safety from natural hazards. BLM regulations for implementing FLPMA ACEC provisions are at Title 43 CFR) Part 1610.7-2(b).

The CYFO and WFO manage nine ACECs in the Planning Area – Carter Mountain, Five Springs Falls, Little Mountain, Sheep Mountain Anticline, Brown/Howe Dinosaur Area, Upper Owl Creek Area, Spanish Point Karst, Red Gulch Dinosaur Tracksite, and Big Cedar Ridge. Refer to Map 84 for the locations of these ACECs in the Planning Area.

Through the public and internal scoping processes, the BLM received a number of nominations for new or expanded ACECs. The BLM reviewed all such nominations to determine if they met the importance and relevance criteria required for consideration as an ACEC as established and defined in 43 CFR 1610.7-2 and outlined in *BLM Manual 1613 – Areas of Critical Environmental Concern* (BLM 1988b). Of the nominations received, 10 new proposed ACECs met the criteria, as did areas adjacent to five existing ACECs (referred to as expansion areas). Table 3-54 lists existing and proposed ACECs, their acreages, the resource value(s) of concern that justify their consideration as ACECs, and identified threats to the areas. Appendix F contains further discussion of the ACEC nomination process, and the ACEC Evaluation Report (BLM 2010b), available on the project website, contains the ACEC evaluation forms completed by the BLM for all existing and proposed ACECs. The ACEC evaluations provide more information about the ACECs identified in this section, including additional references, rationale, and data to support each ACEC nomination.

Table 3-54. Existing and Proposed Areas of Critical Environmental Concern in the Planning Area

Area	Acreage		Value(s) of Concern	Threats
	Existing	Proposed		
Existing ACECs (No Expansion Proposed)				
Big Cedar Ridge	264	N/A	Paleontological	Threats to this ACEC include surface disturbance from mineral and ROW development, and theft and vandalism.
Red Gulch Dinosaur Tracksite	1,798	N/A	Paleontological	Threats to this ACEC include surface disturbance from mineral and ROW development, and theft and vandalism.
Sheep Mountain Anticline	11,520	N/A	Geologic; Caves; Cultural; Scenic	Threats to this ACEC include surface disturbance from mineral and ROW development.
Spanish Point Karst	6,298	N/A	Caves; Recreational; Sinking Stream Segments; Water Quality	Threats to this ACEC include surface disturbance from mineral and ROW development, and aerial spraying of pesticides onto karst aquifer recharge areas.
Existing ACECs (and Proposed Expansion)				
Brown/Howe Dinosaur Area	5,501	15,233	Paleontological	*Existing:* Threats to this existing ACEC include surface disturbance from mineral and ROW development, and theft and vandalism. *Expansion:* Threats to the proposed expansion area of this ACEC include surface disturbance from mineral and ROW development.
Carter Mountain	10,867	5,707	Vegetation; Wildlife *Expansion:* Cultural; Recreational; Special Status Species; Vegetation; Watershed; Wildlife; Soils	*Existing:* Threats to this existing ACEC include surface disturbance from mineral and ROW development, renewable energy development, and theft and vandalism of cultural resources. *Expansion:* Threats to the proposed expansion area of this ACEC include surface disturbance from mineral (including gravel pit) and ROW development, renewable energy development, timber extraction, heavy recreational and motorized vehicle use, and invasive weed infestations. These activities threaten habitat for special status species and have the potential to create disturbances for wintering wildlife.

Table 3-54. Existing and Proposed Areas of Critical Environmental Concern in the Planning Area (Continued)

Area	Acreage		Value(s) of Concern	Threats
	Existing	Proposed		
Five Springs Falls	163	1,646	Recreational; Scenic; Special Status Species *Expansion*: Geologic; Scenic; Public Safety	*Existing:* Rare and endemic plants that occur as a result of the "spray" from Five Springs Falls are in danger when hikers/climbers attempt to climb the wall of the water fall. *Expansion:* Threats to the proposed expansion area of this ACEC include surface disturbance from mineral and ROW development.
Little Mountain	21,475	50,576	Caves; Cultural; Paleontological; Scenic *Expansion:* Recreational; Special Status Species; Vegetation; Wildlife; Scenic	*Existing:* Threats to this existing ACEC include surface disturbance from mineral (including gravel pits, uranium, and limestone) and ROW development, timber extraction, heavy recreational and motorized vehicle use, and invasive weed infestations. These activities threaten habitat for special status species and have the potential to create disturbances for wintering wildlife. *Expansion:* Threats to the proposed expansion area of this ACEC are the same as for the existing ACEC.
Upper Owl Creek Area	13,758	18,975	Cultural; Fish; Recreational; Scenic; Soils; Special Status Species; Vegetation; Wildlife	*Existing:* Threats to this existing ACEC include surface disturbance from mineral and ROW development. *Expansion*: Threats to the proposed expansion area of this ACEC include surface disturbance from mineral and ROW development, timber extraction, and land disposals.
Proposed ACECs				
Chapman Bench	N/A	23,326	Special Status Species; Vegetation; Wildlife	Threats to this proposed ACEC include the resulting probable mining interests when this reserved land is opened to all public land laws. This area was formerly BOR reserved land, and thus had protection from the public land laws and the 1872 mining law. Issuing an opening order, will allow all exploration of resources. Surface disturbance for exploration and claims will have an impact to the resources that are in need of protection: long-billed curlew, mountain plover, and greater sage-grouse.

Table 3-54. Existing and Proposed Areas of Critical Environmental Concern in the Planning Area (Continued)

Area	Acreage		Value(s) of Concern	Threats
	Existing	Proposed		
Clarks Fork Basin/Polecat Bench West Paleontological Area	N/A	23,895	Paleontological; Scenic	Threats to this proposed ACEC include surface disturbance from mineral (including gravel pit, and limestone quarries) and ROW development, timber extraction, heavy recreational and motorized vehicle use, and invasive and nonnative species infestations. These activities threaten habitat for special status species and create disturbances in crucial winter range during critical periods. Heavy public recreational use and existing special recreation permits also threaten recreation experiences. Water quality and quantity issues, as a result of surface and groundwater withdrawals and untreated irrigation outflows, also threaten the area.
Clarks Fork Canyon	N/A	12,249	Geologic; Open Space; Recreational; Special Status Species; Wildlife	Threats to this proposed ACEC include surface disturbance from mineral and ROW development.
Foster Gulch Paleontological Area	N/A	27,302	Paleontological; Scenic	Threats to this proposed ACEC include surface disturbance from mineral and ROW development.
Greater Sage-Grouse Key Habitat Areas	N/A	1,232,583	Special Status Species; Vegetation	Threats to this proposed ACEC include surface disturbance from mineral (including gravel pits) and ROW development, nonrenewable and renewable energy developments, brush eradication programs, prolonged drought, heavy recreational and motorized vehicle use, wildfire, predation, and invasive and nonnative species infestations. These threaten important greater sage-grouse habitats, including breeding, later brood-rearing, and winter concentration areas.
Greater Sage-Grouse Priority Habitat Management Areas	N/A	1,116,698	Special Status Species; Vegetation	Same as above.
McCullough Peaks South Paleontological Area	N/A	6,994	Paleontological; Scenic	Threats to this proposed ACEC include surface disturbance from mineral and ROW development.
Rainbow Canyon	N/A	1,433	Paleontological; Geologic; Scenic	Threats to this proposed ACEC include surface disturbance from mineral and ROW development.

Table 3-54. Existing and Proposed Areas of Critical Environmental Concern in the Planning Area (Continued)

Area	Acreage		Value(s) of Concern	Threats
	Existing	Proposed		
Rattlesnake Mountain	N/A	19,137	Special Status Species; Vegetation; Wildlife	Threats to this proposed ACEC include surface disturbance from mineral (including gravel pits) and ROW development, renewable energy developments, timber extraction, heavy recreational and motorized vehicle use, and invasive and nonnative species infestations. These activities threaten rare plants and habitat for special status species, and have the potential to create disturbances for wintering wildlife.
Sheep Mountain	N/A	25,151	Vegetation; Wildlife	Threats to this proposed ACEC include surface disturbance from mineral (including gravel pit) and ROW development, renewable energy developments, timber extraction, heavy recreational and motorized vehicle use, and invasive and nonnative species infestations. These activities threaten rare plants and habitat for special status species, and have the potential to create disturbances for wintering wildlife.

Sources: BLM 2013a; Appendix F; USFWS 2010 Endangered and Threatened Wildlife and Plants; 12-Month Findings (USFWS 2010); USFWS Conservation Objectives Team (COT) Report (USFWS 2013a); Big Horn Basin Sage-grouse Local Working Group (BHBLWG 2007).

Note: Portions of the Proposed Clarks Fork Basin/Polecat Bench West Paleontological Area, Proposed Foster Gulch Paleontological Area, and Proposed McCullough Peaks South Paleontological Area ACECs make up the proposed PETM ACEC (14,906 acres) under Alternative D. The values of concern listed for those three proposed ACECs are the same for the Proposed PETM ACEC.

ACEC Area of Critical Environmental Concern
BOR Bureau of Reclamation
N/A Not applicable
PETM Paleocene, Eocene Thermal Maximum
ROW rights-of-way

3.7.1.1 Existing Areas of Critical Environmental Concern

Big Cedar Ridge

The Big Cedar Ridge ACEC is on 264 acres of BLM-administered land southwest of Ten Sleep, Wyoming, in Washakie County, in an area of abundant paleontological resources, particularly fossilized plants (Kerr 1992). Fossilized plants were discovered in the Meeteetse Formation in 1990, and the area contains a complete and well-preserved late Cretaceous Period plant community. Sites with such in-place preservation of entire plant communities are rare; however, other sites have been found including two smaller sites in Wyoming and one in New Mexico (Kerr 1992). In addition, 100 previously unknown plant species have been identified at this location (BLM 1997).

Management objectives for the Big Cedar Ridge ACEC are to protect and maintain its paleontological resources in order to provide educational, hands-on experiences for visitors, university studies, and school and paleontological groups, by allowing and promoting collection of reasonable quantities of the fossilized plants for personal use while making negligible disturbance.

Red Gulch Dinosaur Tracksite

The Red Gulch Dinosaur Tracksite ACEC is on 1,798 acres of BLM-administered land off U.S. Highway 14, approximately 10 miles east of Greybull, Wyoming, in Big Horn County. The Red Gulch Dinosaur Tracksite is the largest tracksite in Wyoming. The "basal member" of the lower Sundance Formation contains rare Middle Jurassic dinosaur tracks, which are approximately 167 to 170 million years old. The interval occurs in previously unrecognized intertidal to supratidal carbonate units once thought to be totally marine in origin (Archer et al. 2001). The dinosaur tracks might have been made by at least two types of theropods, meat-eating dinosaurs that walked on their hind legs. Adding to its scientific importance, evidence from this location brings into question assumptions about the geologic history of the area during the Middle Jurassic Period; this location was originally thought to be an ancient sea. Dinosaur tracks in the area have been exposed to surface weathering for varying amounts of time, and new tracks may potentially be exposed each year. The ACEC is also important because of its extensive and unusual Middle Jurassic fossil occurrence. Fossil resources are found throughout the area and include abundant marine fossils such as belemnites, oysters, trilobites, brachiopods, and ammonites, and fossilized plants. In addition, the area consists of the Red Gulch Dinosaur Tracksite recreation area and a small portion of the Red Gulch/Alkali Road National Back Country Byway.

Management objectives and challenges for this ACEC are to protect and maintain paleontological resources. The application of foreign substances such as plaster, resin, and other materials used to make molds has damaged some of the dinosaur tracks in this area. Other types of damage include people scratching circles around tracks or scratching tracks to clean them of sediment. In the outlying areas of the site where more brittle exposures occur, there is evidence of damage to the fossil-bearing surface from people walking on the surface. The possibility remains people could remove or destroy tracks, although removal of individual tracks would be difficult because of the brittle limestone in which the tracks are found.

Sheep Mountain Anticline

The Sheep Mountain Anticline ACEC is on approximately 11,520 acres of BLM-administered land north of Greybull, Wyoming. The ACEC is composed of a classic Laramide anticline, an upward folded rock

structure often featured in geology textbooks. Researchers visit the ACEC and use it for educational field trips. This ACEC also contains several caves that provide recreational, educational, and research opportunities. Some of these caves are of scientific importance because they contain active thermal springs and therefore provide information about the formation of these types of caves and related features.

The management objective for this ACEC is to protect its geological features.

Spanish Point Karst

The Spanish Point Karst ACEC is on approximately 6,298 acres of BLM-administered land on the west slope of the Big Horn Mountains in Big Horn County. The area consists of deeply incised canyon and mountainous terrain, the Medicine Lodge and Trapper Creek WSAs (refer to Section 3.7.6 *Wilderness Study Areas*), several eligible and suitable WSRs (refer to Section 3.7.5 *Wild and Scenic Rivers*), four significant cave and karst systems, sinking stream segments, and regionally important groundwater recharge areas.

Associated with the caves, within the ACEC boundaries, are 45,000 feet of explored cave passages and 100,000 feet of subkarstic waterways. Cave entrances, passages, and waterways in this ACEC serve as a receptacle and circulation system for fresh water originating in the highlands to the east on USFS lands. A portion of the water that circulates through the karsitic system is trapped in the carbonate rocks and recharges the widely used (by both municipalities and irrigators) and economically important Madison aquifer. The Madison aquifer is the source of municipal water for the communities of Worland, Ten Sleep, and Hyattville, and most recently Basin, Greybull, Manderson, and Kirby. The water provides irrigation water for thousands of acres within the Bighorn Basin.

There are recreational opportunities in the area because of its good access for the public, scenic values, and varied potential recreation activities (primarily hiking, rock climbing, and caving). Popular caves in the area include Great X, Tres Charros, Bad Medicine, and P-Bar.

Management objectives for the Spanish Point Karst ACEC are to protect the cave system, sinking stream segments, and groundwater quantity and quality services the area provides.

3.7.1.2 Existing ACECs with Proposed Expansions

Brown/Howe Dinosaur Area

Existing Area

The Brown/Howe Dinosaur Area ACEC is on 5,501 acres of BLM-administered land north of Shell, Wyoming. The area was designated to protect paleontological resources, most notably dinosaur fossils from the suborder Theropoda and Sauropoda that have been recovered there. Tracks of both suborders of dinosaurs have been found in this area, as have soft-tissue fossils. Since the 1930s, the Brown Howe Quarries, which are on nearby private land, have produced hundreds of dinosaur bones. The fossil-bearing sediments continue onto portions of adjacent BLM-administered lands in the ACEC. The Big Al Quarry in the Morrison Formation, on BLM-administered land just north of the Brown Howe Quarries, was the site of the discovery of a nearly complete Allosaurus ("Big Al") skeleton that has subsequently been the subject of several scientific studies and a television program. Additional quarrying is ongoing in this area for dinosaur fossils, such as sauropods, and nonsauropod plant eaters.

Proposed Expansion

The proposed expansion of the Brown/Howe Dinosaur Area ACEC flanks the existing ACEC to the southeast and the northwest and would expand the area by 15,233 acres. As with the existing ACEC, the proposed expansion area contains paleontological resources, primarily from dinosaurs and marine reptiles. This expansion area also typically includes vertebrate fossils and scientifically important paleobotanical, palynological (pollen), mammalian fossil, and dinosaur eggshell site resources.

Management challenges for this area include soil instability, erosion potential, and fossil occurrence that make it vulnerable to surface disturbance. At present, the BLM manages the proposed expansion area as VRM Class II, III, or IV, with approximately 15,160 acres limited to designated roads and trails and 73 acres closed to motorized vehicle use.

Carter Mountain

Existing Area

The Carter Mountain ACEC consists of approximately 10,867 acres of BLM-administered lands on the east slope of the Absaroka Mountains. The BLM manages the area to protect areas of alpine tundra and fragile soils, much of which remains in pristine condition. Some disturbance has occurred in the past, and this juxtaposition of disturbed and undisturbed alpine tundra allows an opportunity to study the effects of disturbance on alpine soils, vegetation, and wildlife. The ACEC also contains scenic areas and provides crucial winter range for elk and mule deer. As stated by Hurley (1996), the Cody elk herd equals or exceeds migratory distances documented for elk, and protection and maintenance of this crucial winter range on Carter Mountain is imperative to the long-term survival of these elk. Recreational opportunities in the ACEC include hunting opportunities pursued by local and visitors from outside the region.

The alpine tundra plant community, which is slow growing and difficult to recover following mechanical disturbance, is responsible for holding fragile soils in the ACEC (Auerbach et al. 1997). The difficulty in recovering these areas is due to a very short growing season, low available water, harsh growing conditions, and desiccation through wind, snow and ice. Alpine environments are indeed "fragile," and may take thousands of years to heal after soil has been lost (Billings 1973). Destruction of the insulating layer of turf can cause thermakarst erosion, which is severe (Billings 1973). Alpine environments can heal from disturbance; however, such recovery depends on the severity of the impact and resistance to disturbance of the vegetation (Billings 1973). Alpine meadows are also susceptible to damage, especially in rocky sites like the Absaroka Mountain Range (Billings 1973). Many other areas in the Absaroka Range are protected as Wilderness, offering greater protection for vegetation and soils than comparable resources receive in the Carter Mountain area.

Proposed Expansion

The proposed expansion of the Carter Mountain ACEC surrounds the area of the existing ACEC and would expand the area by 5,707 acres. Like the existing ACEC, the proposed expansion is a scenic area that contains intact alpine tundra and other habitats, fragile soils, and crucial winter ranges for big game (BLM 2010a). The proposed expansion also contains important habitat for wildlife transition, calving areas, and summer ranges. Elk, deer, and bighorn sheep use the area as they migrate from Yellowstone National Park and the upper reaches of the Shoshone National Forest. In addition, the proposed expansion area supports grizzly bears and grey wolves, and has potential Canada lynx habitat; all three species are current or former listed species (see Section 3.4.9 *Special Status Species – Wildlife*). Three perennial streams in the area support riparian habitat and a pure strain of Yellowstone cutthroat trout

(a BLM sensitive species; see Section 3.4.8 *Special Status Species – Fish*); additional streams in the area might have suitable habitat. Portions of the expansion area contain several special status raptor species and a number of rare and special status species plants (BLM 2010a). The position of Carter Mountain is unique because it is at the edge of the Absaroka Range in an ecotone where species diversity is high. Rare plants often begin to evolve and persist due to the differing ecological pressures of alpine tundra and mountain shrub zones and their phenoplasticity producing ecotypical differentiation. This is why it is more common that these rare plants are found in this zone (see Fertig and Mills 2000).

Management challenges for the area include fragile and unstable soils. In combination with high winds or intense storms, these soils can create hazardous conditions for hikers and other users. At present, the BLM manages this area as VRM Classes II and IV, with 533 acres limited to designated roads and trails and 5,174 acres limited to existing roads and trails for motorized vehicle use.

Five Springs Falls

Existing Area

The Five Springs Falls ACEC consists of 163 acres of BLM-administered public lands on the west slope of the Big Horn Mountains east of Lovell, Wyoming. The BLM objective for managing the ACEC is to protect existing populations of four near-endemic rare and sensitive plant species in the Five Springs Falls area; see BLM 2010a for information about these plant species. This ACEC also contains the Five Springs Falls Campground, which attracts local and Yellowstone National Park visitors. Waterfalls in the steep rocky canyon that makes up the ACEC are public recreational and scenic attractions.

Proposed Expansion

The proposed expansion of the Five Springs Falls ACEC is south and west of the existing ACEC and would expand the area by 1,646 acres. The area of the proposed expansion is dominated by outcrops of highly folded, faulted, and forested limestones and Paleozoic age dolomites. The area is unstable due to steep topography. Downslope movements of soil and rock are common, and landslide deposits and rock-fall (slump) have been documented in the area. This natural phenomenon can pose a risk to public safety. The area also has unstable soil, erosion potential, and fossil occurrence that make it vulnerable to continued surface disturbance and loss of paleontological resources. At present, the BLM manages this area as VRM Classes II and III, with motorized vehicle use limited to designated roads and trails.

Little Mountain

Existing Area

The Little Mountain ACEC consists of approximately 21,475 acres of BLM-administered land on the west slope of the Big Horn Mountains northeast of Lovell, Wyoming. BLM objectives for managing the ACEC are to protect and manage important caves and cave-related paleontological resources, cultural resources, and the maintenance of scenic values. The Little Mountain ACEC contains several caves used by the public for recreational, educational, and research purposes. This ACEC provides hunting opportunities. The area also contains AML hazards due to previous uranium mining activities (refer to Section 3.8.3 *Health and Safety*).

Proposed Expansion

The proposed expansion of the Little Mountain ACEC includes areas east and south of the existing ACEC and would expand the area by 50,576 acres. This expansion area is proposed due to identified wildlife, special status species, recreation, vegetation, and scenic values. The proposed expansion area includes

big game winter, transition, and calving areas; migration corridors; and a bighorn sheep population (see Section 3.4.6 *Fish and Wildlife Resources – Wildlife*). A number of BLM sensitive wildlife species and regionally endemic plant species can be found in the area. Potential Canada lynx habitats and greater sage-grouse brood-rearing, nesting, and winter range can also be found in this area. Lynx Analysis Units in the proposed expansion area were determined in coordination with the USFWS and USFS to provide suitable lynx habitat and to be functional with the adjacent USFS suitable habitat (Lynx Biology Team 2000). Desired plant communities in the proposed expansion area include a portion of the only curl-leaf mountain mahogany population in Wyoming. Recreational use (including hunting, fishing, wildlife viewing, and visitation to the nearby medicine wheel archeological site) is heavy. Scenic resources in the area include deep canyons (including Devil's Canyon and Cottonwood Canyon) and high plateaus that contain paleontological resources. At present, the BLM manages the area as VRM Classes II and III, with motorized vehicle use limited to designated roads and trails.

Upper Owl Creek

Existing Area

The Upper Owl Creek ACEC includes 13,758 acres of BLM-administered public lands in the upper foothills of the Absaroka Mountains surrounding the Owl Creek, Rock Creek, Klicker Creek, Slab Creek, and Vass Creek drainages. BLM management objectives for the area are to protect overlapping and important big game habitats and migration corridors, fisheries habitat, shallow soils, alpine vegetation and rare plants, cultural resources and Native American traditional values, primitive recreational opportunities, and scenic quality (BLM 1998a). The ACEC contains wildlife resources and special status species (including migratory birds, wolves, grizzly bears, moose, and wolverines), cultural resources, and primitive recreational opportunities such as hiking, camping, fishing, and horseback riding. Desired plant communities include endemic plants species growing in "moonscapes" where rocky, sparsely-vegetated soils support low-growing, cushion plant communities, and forested areas that include old-growth tree stands. This ACEC also provides hunting opportunities.

Proposed Expansion

The proposed expansion of the Upper Owl Creek ACEC includes areas east and south of the existing ACEC and would expand the area by 18,975 acres. BLM management objectives and resource values for this area are similar to those in the area of the existing Upper Owl Creek ACEC. At present, the BLM manages the area as VRM Classes II and III, with 18,080 acres limited to designated roads and trails and 1,640 acres limited to existing roads and trails for motorized vehicle use.

3.7.1.3 Proposed ACECs

Chapman Bench

The proposed Chapman Bench ACEC (23,326 acres) is north of Heart Mountain National Landmark and east of Highway 120 in an area of predominantly BLM-administered land. The area contains sagebrush habitat used by sensitive bird species and other wildlife.

The proposed ACEC is an Audubon Society-designated important bird area, and the area contains a diverse and abundant bird population map (Taylor 1986) of this important bird area http://netapp.audubon.org/IBA/State/US-WY). The Chapman Bench area supports at least 12 sensitive species. Greater sage-grouse, long-billed curlew, and mountain plover occur in this sagebrush steppe; all three are BLM sensitive. These sensitive bird species prefer shortgrass or vegetation cover and bare

ground, and they have evolved in disturbance regimes that include grazing and fire. Both these regimes can modify a vegetation community to be more suitable; however, it should be noted that these species also select short stature vegetation types like gardener saltbush dominated sites and blue grama dominated sites regardless of disturbance regimes. Sagebrush obligate species in the area also include the sage thrasher, sage sparrow, Brewer's sparrow, and loggerhead shrike. This area provides nesting habitat for one of the highest concentrations of these species together in the Bighorn Basin. In addition, this area provides pronghorn and mule deer crucial winter range. Visitors travel the area, which provides views of the Absaroka Mountain foothills, on their way to Yellowstone National Park.

At present, the BLM manages this area as VRM Classes II, III, and IV, and motorized vehicle use is limited to existing roads and trails. There has been little development in the proposed ACEC to date.

Clarks Fork Basin/Polecat Bench West Paleontological Area

The proposed Clarks Fork Basin/Polecat Bench West Paleontological Area ACEC (23,895 acres) is west of Powell, Wyoming, in Park County, in the northwestern corner of the Planning Area. The ACEC is proposed to protect the area's stratigraphic contact zone and the paleontological and geochemical values associated with these rock layers, which are exposed in only a few areas worldwide. The area contains mammalian and botanical fossil resources and its geologic information relates to global warming and paleoclimate change. This stratigraphic boundary represents a transition from the Paleocene Epoch to the Eocene Epoch, and produces fossils and geochemical data used in the study of a major Carbon Isotope Excursion recorded during a period of global warming (the Paleocene-Eocene Thermal Maximum). The area also contains scenic and colorful badlands and eroded features.

Management challenges for this area include soil instability, erosion potential, and fossil occurrence that make it vulnerable to surface disturbance and the loss of its identified resource values. At present, the BLM manages this area as VRM Classes III and IV, with motorized vehicle use limited to existing roads and trails.

Clarks Fork Canyon

The proposed Clarks Fork Canyon ACEC (12,249 acres or 4,746 acres depending on the management alternative) is in the far northwestern portion of the Planning Area. The ACEC is proposed to protect the area's geologic, wildlife and special status species habitat, open space, and recreational resources and uses. The geology of the Clarks Fork Canyon, the Canyon Mouth Anticline, and glacial features in the area are of scientific and educational value. The area contains crucial winter range for mule deer, elk, and moose, one of only two ranges for mountain goats in the state, and one of the largest bighorn sheep ranges in the country. The area provides habitat for several species of raptors and contains caves with bat hibernacula and roost sites. Special status species in the proposed ACEC include plant species (such as Shoshonea and Ute ladies'-tresses), habitat for BLM sensitive wildlife species (such as greater sage-grouse, mountain plover, long-billed curlew, sage thrasher, Brewer's sparrow, Baird's sparrow, and loggerhead shrike), and BLM sensitive Yellowstone cutthroat trout. The Clarks Fork area provides opportunities for recreation on large unbroken tracts of public land, including a segment of the Clarks Fork of the Yellowstone River WSR eligible waterway.

At present, the BLM manages this area as VRM Class II, and motorized vehicle use is limited to existing roads and trails with seasonal management restrictions.

Foster Gulch Paleontological Area

The proposed Foster Gulch Paleontological ACEC (27,302 acres) is 10 miles south of Lovell, Wyoming, in Big Horn County. The ACEC is proposed to protect the area's stratigraphic contact zone and the paleontological and geochemical values associated with these rock layers, which are exposed in only a few areas worldwide. The area typically contains mammalian and botanical fossil resources, and its geologic information relates to global warming and paleoclimate change. This stratigraphic boundary represents a transition from the Paleocene Epoch to the Eocene Epoch (the Fort Union/Willwood formations) and produces fossils and geochemical data used in the study of a major Carbon Isotope Excursion recorded during a period of global warming (the Paleocene-Eocene Thermal Maximum). The area also contains scenic and colorful badlands and eroded features.

Management challenges for this area include soil instability, erosion potential, and fossil occurrence that make it vulnerable to surface disturbance and the loss of its identified resource values. At present, the BLM manages the area as VRM Class IV, with motorized vehicle use limited to existing roads and trails.

Greater Sage-Grouse Key and Priority Habitat Management Areas

The proposed Greater Sage-Grouse Key Habitat Areas ACEC encompasses BLM-administered lands in Key Habitat Areas (1,232,583 acres), while the Greater Sage-Grouse PHMAs ACEC encompasses BLM-administered lands in PHMAs (1,116,698 acres). These ACECs encompass large portions of the Planning Area (39 percent of BLM-administered surface for the Greater Sage-Grouse Key Habitat Areas ACEC and 35 percent for the PHMAs ACEC). Both proposed ACECs are discussed together, since both met the same relevance and importance criteria and contain the same values of concern.

The BLM has identified the priority greater sage-grouse habitat encompassed by the proposed Key and PHMAs ACECs as highly important to the health and viability of greater sage-grouse populations. The sagebrush steppe has been identified as one of the most threatened ecosystems in America (Stiver et al. 2006). Numerous sagebrush obligate species are dependent on healthy, intact sagebrush steppe ecosystems and are put at risk by its decline. The primary threats to the Wyoming Basin greater sage-grouse population include energy development and transfer, long-term drought, and brush eradication programs (USFWS 2013b). In addition, sagebrush steppe area provides habitat for numerous BLM sensitive species, including greater sage-grouse, Brewer's sparrow, sage thrasher, sage sparrow, loggerhead shrike, mountain plover, burrowing owl, white-tailed prairie dog, black-tailed prairie dog, long-billed curlew, and Baird's sparrow. Portions of the ACEC in Chapman Bench and Loch Katrine that contain sagebrush steppe habitat are designated as important bird areas by the Audubon Society. Many other animal species are also dependent upon this ecosystem for grazing, pollination, winter range, nesting areas, and birthing areas. For example, pronghorn, though not a sensitive species, are dependent on the sagebrush steppe; Wyoming supports the majority of this species' population.

McCullough Peaks South Paleontological Area

The proposed McCullough Peaks Paleontological Area ACEC (6,994 acres) is adjacent to the McCullough Peaks WSA (which forms the proposed ACEC's northeastern boundary), east of Cody, Wyoming, in Park County. The ACEC is proposed to protect the area's stratigraphic contact zone and the paleontological and geochemical values associated with these rock layers, which are exposed in only a few areas worldwide. The area typically contains mammalian and botanical fossil resources and its geologic information relates to global warming and paleoclimate change. This stratigraphic boundary represents a transition from the Paleocene Epoch to the Eocene Epoch (the Fort Union/Willwood formations) and produces fossils and geochemical data used in the study of a major Carbon Isotope Excursion recorded

during a period of global warming (the Paleocene-Eocene Thermal Maximum). The area also contains scenic and colorful badlands and eroded features.

Management challenges for this area include soil instability, erosion potential, and fossil occurrence that make it vulnerable to surface disturbance and the loss of its identified resource values. At present, the BLM manages the area as VRM Classes II and III, with motorized vehicle use limited to designated roads and trails.

Rainbow Canyon

The proposed Rainbow Canyon ACEC (1,443 acres) is at the foot of the western Big Horn Mountains in Big Horn County, near the northeastern corner of the Planning Area. The BLM acquired access easements using Land and Water Conservation Funds that provide public access across the private land between Wyoming State Highway 14A and public land where Rainbow Canyon is located.

The public access is needed in order to develop Rainbow Canyon as a recreation site involving a scenic overlook.

The proposed ACEC contains scenic and geologic resources, and paleontological resources that include dinosaurian and paleobotanical fossils. The area is dominated by outcrops of the Cretaceous Cloverly Formation, which is known for early Cretaceous dinosaur fossils. These important scientific resources are found throughout large portions of the area. The geology of the area is weathered and eroded, creating a colorful landscape. The viewscape in the ACEC is dominated by exposed beds of the Cloverly Formation, which includes dramatic pink, lavender, and white beds that are exposed in mirror images across the drainage. Though the Cloverly Formation can be found around the Bighorn Basin, the colorful bands presented in the Rainbow Canyon stand out in counter-relief below the backdrop of tan and black Cretaceous shales; this quality is distinct from other bas-relief areas of badlands in the region.

Management challenges for this area include soil instability, erosion potential, and fossil occurrence that make it vulnerable to surface disturbance and the loss of its identified resource values. At present, the BLM manages this area as VRM Class III, with motorized vehicle use limited to designated roads and trails.

Rattlesnake Mountain

The proposed Rattlesnake Mountain ACEC (19,137 acres) is approximately 5 miles northwest of Cody and immediately north of the Buffalo Bill Reservoir. The area is proposed to protect wildlife habitat and desired plant communities, including special status plant species; see BLM 2010a for information about these plant species. The proposed ACEC contains winter, transition, and calving areas for elk, mule deer, and moose (WGFD 2011b). The winter ranges in this area are the eastern-most terminuses of some of the longest intact migration routes in the lower 48 states. The area also contains grizzly bear and gray wolf habitat, and potential Canada lynx habitat. While the area does not contain Lynx Analysis Units, it does contain spruce habitat which meets standards in the Canada Lynx Conservation Assessment and Strategy 2000 (Lynx Biology Team 2000) as suitable habitat and is linked to other suitable habitat to the west. Bird habitat in the area includes greater sage-grouse brood-rearing and migratory bird nesting areas. Watersheds that comprise the area drain into the north fork of the Shoshone River, which provides cold water fisheries habitat. The area is used for hunting and other recreational activities. Important vegetation types and sensitive plant species in the area include mixed conifer and aspen stands and riparian willow, sagebrush, and mountain shrub communities. The unusual aspect of the vegetation habitat in this area is the volcanic, Precambrian, and limestone soils (associated with the

Laramide Orogeny), which provide habitat for rare and BLM sensitive plant species. At present, the BLM manages the area as VRM Class II.

Sheep Mountain

The proposed Sheep Mountain ACEC (25,151 acres or 14,200 acres depending on the management alternative) is immediately west of Buffalo Bill Reservoir in the northwestern quadrant of the Planning Area. The area is proposed to protect important wildlife habitat and desired plant communities. The area contains big game winter, transition, and lambing areas, and migration corridors that link USFS land and Yellowstone National Park with available habitat for wintering and raising young (WGFD 2011b). The area also contains grizzly bear and gray wolf habitat, potential Canada lynx habitat, and greater sage-grouse brood-rearing and migratory bird nesting habitat. While the area does not contain Lynx Analysis Units, it does contain spruce habitat, which meets standards in the Canada Lynx Conservation Assessment and Strategy 2000 (Lynx Biology Team 2000) as suitable habitat and is linked to other suitable habitat to the west. Drainages in the area provide cold water fisheries habitat. The area is used for hunting and other recreational activities and contains visual alignments associated with the equinox and solstice.

Important vegetation types and sensitive plant species in the area include mixed conifer and aspen stands, riparian willow, sagebrush, and mountain shrub communities. The unusual aspect of the vegetation habitat in this area is the volcanic and limestone soils (associated with the Heart Mountain Detachment), which provide habitat for rare and BLM sensitive plant species.

At present, the BLM manages this area as VRM Class II. The area contains 22,926 acres limited to designated roads and trails and 2,227 acres limited to existing roads and trails for motorized vehicle use.

3.7.2 National Back Country Byways

The BLM began a back country byway program in 1989 to focus on enhancing recreational opportunities. Two years later, Section 1047 of the Intermodal Surface Transportation Efficiency Act of 1991 established the National Scenic Byway System. Section 1032 of the Act recognized the BLM's Back Country and Scenic Byways program as a component of the National Scenic Byway System. The objectives of the BLM's Back Country and Scenic Byways program include:

- Enhance opportunities for the American public to see and enjoy the unique scenic and historical opportunities on public lands.
- Foster partnerships at local, state, and national levels.
- Contribute to local economies.
- Enhance visitors' recreation experiences and communicate the multiuse management message through effective interpretative programs.
- Manage visitor use along the National Back Country Byway to minimize impacts to the environment and to protect visitors.
- Contribute to the National Scenic Byway System in a way that is uniquely suited to BLM-administered national public lands.

Red Gulch/Alkali Road National Back Country Byway

The BLM manages one National Back Country Byway in the Planning Area – the Red Gulch/Alkali Road National Back Country Byway. This route is a 32 mile gravel road that provides a scenic drive through

the foothills of the Big Horn Mountains and access to three WSAs and the Red Gulch Dinosaur Tracksite ACEC. Active promotion of the Red Gulch/Alkali Road National Back Country Byway has been limited to available brochures and interpretive kiosks at either end of the route, and its proximity to the Red Gulch Dinosaur Tracksite, which attracts thousands of visitors per year. Local and out-of-state visitors familiar with the area constitute most recreational use. These visitors are generally comfortable with the experience and enjoy the seclusion and the panoramic scenery of the Big Horn Mountains and the Bighorn Basin and the experience, opportunities, and benefits that come from the local areas accessible via the National Back Country Byway.

Management Challenges

Management challenges for the Red Gulch/Alkali Road National Back Country Byway include improving visitor safety and managing for multiple-use resource activities while maintaining the scenic character of the landscape. Outdoor enthusiasts unfamiliar with the area can become intimidated by the type II and III road conditions and limited signage. Hazardous road conditions along this route include a narrow running surface, deep ruts, steep slopes, and soil types that become extremely muddy and slippery during times of inclement weather, even light rain. The route is impassable during winter. Additional signage and increased visitor information is needed to ensure public safety along the Red Gulch/Alkali Road National Back Country Byway.

Multiple-use resource activities have remained limited in the corridor of the National Back Country Byway. Visual intrusions along the byway do not disrupt the overall character of landscape. However, impacts of dispersed recreation, including OHV use, are becoming apparent and can be attributed to the popularity of the area during the hunting season and as a location for horn hunting.

3.7.3 National Historic Landmarks

There is one National Historic Landmark in the Planning Area – the Heart Mountain Relocation Center National Historic Landmark.

The Heart Mountain Relocation Center is a National Historic Landmark designated by the Secretary of the Interior under 36 CFR 65.5. From 1942 through 1945, 14,000 Japanese-Americans passed through the Heart Mountain Relocation Center. At its peak population of approximately 11,000 (two-thirds of whom were American citizens), Heart Mountain was the state's third largest community. The center was built to house some of the 110,000 persons evacuated from the West Coast following the Japanese attack on Pearl Harbor in December 1941. The Heart Mountain Relocation Center is a reminder of a unique episode in American history and is relevant to the military, social, and political history of the Nation (Heart Mountain Wyoming Foundation 2009; NPS 2009).

3.7.4 National Historic Trails and Other Historic Trails

A National Historic Trail (NHT) is a congressionally designated trail that is an extended, long-distance trail, not necessarily managed as contiguous, that follows as closely as possible and practicable the original trails or routes of travel of national historic significance. The purpose of a NHT is the identification and protection of the historic route and the historic remnants and artifacts for public use and enjoyment. A NHT is managed in a manner to protect the nationally significant resources, qualities, values, and associated settings of the areas through which such trails may pass, including the primary use or uses of the trail (BLM 2012c).

In accordance with BLM Manual 6280 (BLM 2012d), the BLM establishes a National Trail Management Corridor where a designated trail is within the Planning Area and sets forth allocation decisions, management actions, and necessary restrictions for resources and resource uses within that National Trail Management Corridor. The Oregon/Mormon NHTs Management Plan (Trails Management Plan) (BLM 1986b) provides specific guidelines for the evaluation and protection of historic wagon trails that apply to all historic trails of either national, regional, or local significance (whether or not the trail is a wagon trail). The BLM manages and protects trails in the Planning Area using these guidelines. The guidelines specifically focus on (1) historical significance and use, (2) the integrity of the setting of the trail segment, and (3) the physical integrity of the trail, including ruts and swales.

As a result of these guidelines, the BLM developed the concept of a protective corridor "at the discretion of individual districts," and defined this management corridor as "a width of ¼ mile either side of the trail or the visual horizon, whichever is less..." (BLM 1986b). At that time, the BLM considered the 0.25-mile management corridor sufficient to identify and protect physical remnants and associated sites. The overall trail setting or viewshed was of secondary importance to preserving the physical evidence. Although developed for the primary routes and important ancillaries to the Oregon/Mormon Pioneer NHTs, in the current RMPs for the Planning Area, the BLM also applied the corridor concept to other historic trails. Subsequent project-specific consultation has indicated that development activity beyond the 0.25-mile management corridor can adversely affect the qualities that contribute to a trail's eligibility. In recent years, the BLM has employed viewshed analysis techniques from VRM guidance to determine the extent of the effects of development activities on nearby trails and other important historic properties.

Trails and Routes in the Planning Area

There is one NHT in the Planning Area – the Nez Perce (Nee-me-poo or Nimi'ipuu) NHT (Maps 91 and 92) (USFS 1990). A total of 16.49 miles of the Nez Perce NHT occurs within the Planning Area, 4.67 miles of which travel across BLM-administered land. The Nez Perce NHT was established by Congress through Public Law 99-445 on October 6, 1986 which amended the National Trail System Act of 1968 to designate the Nez Perce Historic Trail as a component of the National Trails System. The Nez Perce NHT was designated to commemorate the 1877 flight of the non-treaty Nez Perce from their homelands in eastern Oregon, Idaho, and Washington. Five Nez Perce bands, nearly 800 men, women, and children, struggled across 1,170 miles of rugged country. The course they chose on their epic journey has been memorialized in the Nez Perce NHT. In its entirety the, Nez Perce NHT covers 1,170 miles, 319 miles of which have been designated high potential segments.

The Nez Perce NHT follows a mixture of nonmotorized trails and motorized roads and generally follows the route depicted in the "Nez Perce (Nee-Me-Poo) Study Report", prepared by the Department of Agriculture in March, 1982 and the Environmental Assessment and Decision Notice signed by Assistant Secretary of Agriculture Peter C. Myers on July 1, 1985 (16 U.S.C.1244 [a][14]). Motorized use is allowed where the Nez Perce NHT overlaps an existing road and along the auto tour route. Where the Nez Perce NHT follows BLM system trails, the Nez Perce NHT is regarded as a simple facility for hikers and horsemen (USFS 1990).

Highways that roughly parallel the 1877 Nez Perce flight and have been designated as the official Nez Perce NHT Auto Route. Through the cooperative efforts of the USFS and the states of Oregon, Idaho, Washington, Wyoming, and Montana, 1,500 miles of selected roadway now display the Nez Perce Auto Route sign. In the Bighorn Basin Planning Area, the Auto Route travels from the Shoshone National

Forest boundary along the Chief Joseph National Scenic Byway (Wyoming Highway 296) where it trends north on Wyoming Highway 120 to the state line.

The portion of the Nez Perce NHT that passes through the Planning Area is one of the few segments where the "nontreaty" bands were successful in concealing their route of travel from the Army and its scouts. The Nez Perce separated into small groups and used a variety of routes, most of which remain unknown today. Warriors created false trails in hopes of gaining time for the main body of the tribe to travel north toward Canada. As a result of this history, there are no "High Potential Route Segments" or "high potential trail historic sites" identified in the *Nez Perce (Nee-me-poo or Nimi'ipuu) National Historic Trail Comprehensive Plan* within the Planning Area (USFS 1990). As a Congressionally designated historic trail, land management considerations include applying constraints such as no surface disturbance within 0.25 mile of the trail, or the visual horizon, whichever is closer. This results in a 0.5-mile-wide management corridor centered on the trail. Specific segments also have a no surface occupancy (NSO) stipulation.

The Nez Perce NHT corridor protects the historical values for which the trail was designated while providing a high quality scenic, primitive hiking, and pack and saddle stock experience. Activities within the Nez Perce NHT corridor will not preclude further management options for the Nez Perce NHT. A variety of compatible recreation opportunities are provided. Access to the Nez Perce NHT is primarily by foot and horseback. Roads and motorized trails are not present except at designated crossings.

The Nez Perce NHT corridor is characterized by a predominantly natural appearing environment. Improvements such as trailheads, trails, signs, bridges, and fences that enhance the recreation opportunities may be present. Evidence of past and present resource management may exist, but blends with the natural appearance of the landscape. Vegetation alterations may be present to enhance viewing opportunities.

The Nez Perce NHT is managed to protect its historical values while providing recreation opportunities in a natural appearing landscape consistent with *National Historic Trail Comprehensive Plan* within the Planning Area (USFS 1990) and any revisions therefore after.

A number of other trails and historic routes traverse the Planning Area. Other historic trails total 271.76 miles in the Planning Area, 69.08 miles of which travel across BLM-administered land (Maps 91 and 92). Trails dating to before contact between Native Americans and European Americans include the Bad Pass, or Sioux Trail. This foot trail is marked by a line of stone cairns of unknown age and might date from many thousands of years ago. Although the date of its earliest use is not known, records do establish that the trail was much traveled by peoples from pre-Columbian times up to the middle 1830s. Mountain men used the trail through Bighorn Canyon to bring furs from the Bighorn Basin east to the Missouri River. Portions of the Sioux Trail underlie a scenic byway in the eastern Bighorn Basin. Another such prehistoric trail network, the Bannock Trail, is thought to exist on the East Slope of the Absaroka Mountains, but its exact route is not known.

Routes from the historic period include the Bridger Trail, which Jim Bridger created in 1864 to connect with the Oregon Trail to the south (Maps 91 and 92). The route was an important alternative to the Bozeman Trail, which crossed the Powder River Country. Before the railroad was constructed, the Bridger Trail was an important freight route for wagons carrying supplies during the early settlement of the Bighorn Basin in the 1880s and 1890s. The trail connected the Bighorn Basin with Billings, Montana, to the north and Casper, Wyoming, to the southeast. Portions of the Bridger Trail along Kirby Creek were used on the later stage route connecting Thermopolis and Lost Cabin with Casper (Woods 1997). The BLM has installed interpretive signage along the Bridger Trail.

In 1881, Meeteetse became a terminus of the old Meeteetse Trail, which the military built as a stage and freight road. The Fort Washakie to Meeteetse to Red Lodge trail originally ran north from Fort Washakie to Meeteetse. Freight was shipped north from the Union Pacific Railroad to Fort Washakie and then on to Meeteetse; when the railroad reached Red Lodge the traffic pattern reversed, from north to south. The trail was the first road built in the Bighorn Basin. Red Lodge Road was later extended to Lander and Rawlins.

Although eclipsed in importance by railroads and other routes, the Bridger Trail was the predecessor to the increased system of roads connecting ranches and towns with expanding railheads in the Bighorn Basin. The Chicago, Burlington & Quincy Railroad completed its line from Toluca, Montana, to Cody, Wyoming, in 1901, and continued it south along the Bighorn River to Kirby by 1905. The rail line was completed through the Wind River Canyon to Casper in October 1914. The Chicago & North Western Railroad built into Casper by 1888 and expanded west to Shoshone, Riverton, and Lander by 1906 (Larson 1978).

Early automobile routes still in use today include the Yellowstone Highway (U.S. Highway 20) (part of the Park to Park Highway) and the Black and Yellow Trail (Highway 16), both examples of some of the earliest modern-era highways traversing the diverse geographical regions of Wyoming.

Management Challenges

Historic trails are among the most difficult resources to manage because of "their varying degrees of preservation and diverse range of environmental settings" (BLM 1986b). Trails in the region in general are under increased pressure as a result of the cumulative effects of energy development and large-scale projects. The area with the highest potential for wind farm development in the Bighorn Basin is close to the Nez Perce NHT. Current BLM management practices for NHTs include the following:

- Avoid surface disturbance within the viewshed of historic trails.
- Minimize the effect of trail crossing by utilizing existing ROWs crossing areas.
- Utilize VRM techniques to minimize effects to the setting of NHTs and other regionally important roads and trails.
- Limit surface disturbance within 0.25 mile or the visual horizon (whichever is closer) of historic trails.
- Avoid running a linear project parallel to a trail.
- Cross trails or historic routes at 90-degree angles using a dog-leg or an S-curve.
- Relocate the proposed disturbance where it will be less visible from the trail (e.g., behind a rise).
- Restrict the width of a working ROW within management corridor on either side of a trail.
- Avoid any blading on a ROW within management corridor if a track will suffice.
- Consider special rehabilitation measures (e.g., revegetation) that will help reestablish the visual integrity of the trail.
- Consider special interpretive measures (e.g., signing).
- Consider special preventive measures (e.g., fencing) to reduce the area affected by the project.

3.7.5 Wild and Scenic Rivers

The National Wild and Scenic River System (NWSRS) is a series of nationally designated waterways and their immediate environments (the land within the waterway corridors). Wild and Scenic Rivers (WSRs) are designated under the authority of the Wild and Scenic Rivers Act of 1968 (Public Law 90-542, as amended; 16 USC) for the purpose of preserving the stream or stream section in its free-flowing condition, preserving water quality, and protecting its outstandingly remarkable values (ORVs). ORVs are identified on a segment-specific basis and may include scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Section 5(d)(1) of the Wild and Scenic Rivers Act directs federal agencies to consider potential wild and scenic rivers in their land and water planning process. To fulfill this requirement, the BLM evaluates streams for potential inclusion into the NWSRS when developing or revising its RMPs. The NWSRS consists of three types of rivers, as follows:

- *Recreational* — rivers or sections of rivers readily accessible by road or railroad and might have some development along their shorelines and might have undergone some impoundments or diversion in the past.
- *Scenic* — rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped but accessible in places by roads.
- *Wild* — rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

Of the 12,560 miles of waterways that are part of the NWSRS, approximately 2,423 miles of WSRs are on BLM-administered land (Interagency Wild and Scenic Rivers Coordinating Council 2008). BLM Manual 6400, Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, and Management, provides guidance for implementing the Wild and Scenic River Act for these WSRs (BLM 2012e). The BLM is responsible for evaluating all rivers on BLM-administered land to determine if they are suitable for addition to the NWSRS and making recommendations to Congress accordingly. Ultimately, the BLM uses the RMP revision process, including comments received on the Draft RMP and Draft EIS to determine which if any of the waterways in the Planning Area to recommend as suitable to Congress for addition to the NWSRS.

At present, there are no designated WSRs in the Planning Area. However, the CYFO and WFO manage lands along 20 waterways that have been found eligible for WSR designation (Map 94). All contain ORVs, such as scenic and geologic (remarkable vistas due to the steep vertical canyon walls, some areas are more than 1,200 feet deep, immense spires, and riparian valley bottoms), cultural, historical, fish, recreational, sinking streams, and aquifer recharge zones. These waterways were identified during a review of all BLM-administered public lands along waterways within the Planning Area. This review was done to determine eligibility, assign a tentative classification, and screen for suitability factors, as identified in the Wild and Scenic Rivers Act of 1968, as amended. Along the 20 eligible waterways, 14 waterway segments were found to meet the suitability factors.

Step I – Eligibility Criteria

The BLM has assessed 297 waterways in the CYFO and WFO Planning Areas (BLM 2002a; BLM 2003a; BLM 2009p). There was a review of waterways in the CYFO Planning Area in 1993 (with an update to management prescriptions in 2003 and an addendum report in 2009) and a review of waterways in the WFO in 2002 (BLM 2003a; BLM 2002a). These reports are available on the Bighorn Basin RMP Revision Project website and contain detailed descriptions of the waterway identification and review processes. To begin these reviews, the BLM identified natural waterways (including both perennial and

nonperennial rivers and streams) in the Planning Area based on guidance in BLM Manual 6400. Following this initial inventory, BLM Interdisciplinary Team members reviewed the waterways to determine if they met eligibility criteria of being free-flowing and containing at least one of the ORVs described in BLM Manual 6400. These ORVs include scenic, recreational, geologic, fish, wildlife, cultural, historic, and other similar values (e.g., ecologic/biologic diversity, paleontologic, or botanic values). Of the 297 waterways reviewed, 277 were found to not meet the definition of free-flowing or to not possess ORVs. The BLM subsequently dismissed these 277 waterways from further consideration. The BLM preliminary determined that 20 waterways meet the WSR eligibility criteria, and tentatively classified all eligible waterway segments as wild, scenic, or recreational, based on the degree of development along the waterway and on adjacent lands at the time of the evaluation. Table 3-55 lists these waterways, their lengths, the acreage of BLM-administered land within their waterway corridors, their ORVs, and their tentative classifications.

Where necessary to protect the values that made them eligible for inclusion in the NWSRS, the BLM developed specific interim management prescriptions for the public lands along eligible waterway segments. These interim management prescriptions were designed to protect the identified ORVs and maintain the tentative classifications assigned to these waterways. Where specific interim management prescriptions were not developed, the BLM used case-by-case evaluations of discretionary actions (e.g., oil and gas leasing) to ensure activities that could degrade ORVs or free-flowing conditions would be avoided. Chapter 2 lists the current management of these eligible waterway segments.

Table 3-55. Characteristics for Wild-and-Scenic-River-Eligible Waterways in the Planning Area

Waterway	Total Length of Waterway Reviewed (miles)	Total Length of Segments on BLM-administered Lands (miles)	Tentative Classification	Outstandingly Remarkable Values	Waterway Segment (BLM-administered Land) Meets Suitability Screening Factors?
Clarks Fork of the Yellowstone[1]	14.08	8.51	Scenic	Cultural; Fish; Geologic; Historic; Other Values (whitewater); Recreational; Scenic; Wildlife	Yes (downstream 4.74 miles) No (upstream 3.77 miles)
Cottonwood Creek	4.05	4.05	Scenic	Geologic; Historic; Other Values (endemic/rare vegetation, aspen stands, riparian); Scenic; Wildlife	Yes
Cow Creek	2.01	1.92	Wild	Cultural; Geologic; Historic; Other Values (aspen stands, riparian, endemic/rare vegetation); Scenic; Wildlife	Yes
Deer Creek	1.46	1.45	Scenic	Cultural; Fish; Recreational; Scenic	Yes
Meeteetse Creek	3.31	2.78	Wild	Geologic; Historic; Other Values (riparian, alpine vegetation, volcanic-specialized vegetation); Wildlife	No
North Fork Shoshone River	4.87	0.85	Recreational	Cultural; Fish; Geologic; Historic; Recreational; Scenic; Wildlife	No
Oasis Spring Creek	2.40	2.07	Wild	Cultural; Fish; Recreational; Scenic	No
Pat O'Hara Creek	7.63	2.17	Scenic	Cultural; Historic	No
Porcupine Creek	10.80	10.80	Wild/Scenic	Cultural; Fish; Other Values (riparian); Recreational; Scenic	Yes
South Fork Shoshone River	19.15	1.99	Recreational	Cultural; Fish; Geologic; Historic; Recreational; Scenic; Wildlife	No
Trout Creek	1.30	0.96	Wild	Cultural; Fish; Other Values (riparian); Recreational; Scenic	Yes
Canyon Creek	1.30	1.30	Scenic	Cultural	No
Deep Creek	5.20	5.20	Wild	Fish; Recreational; Scenic	Yes
Dry Medicine Lodge Creek	10.61	10.59	Scenic	Cultural; Geologic; Other Values (caving, aquifer recharge); Recreational; Scenic	Yes
Kirby Creek	2.11	0.10	Recreational	Historic	No

Table 3-55. Characteristics for Wild-and-Scenic-River-Eligible Waterways in the Planning Area (Continued)

Waterway	Total Length of Waterway Reviewed (miles)	Total Length of Segments on BLM-administered Lands (miles)	Tentative Classification	Outstandingly Remarkable Values	Waterway Segment (BLM-administered Land) Meets Suitability Screening Factors?
Medicine Lodge Creek	5.77	5.70	Wild	Cultural; Geologic; Other Values (sinking streams, aquifer recharge); Recreational; Scenic	Yes
Paint Rock Creek Unit (Paint Rock Creek, South Paint Rock Creek, and Laddie Creek)	13.77	11.18	Recreational	Cultural; Fish; Geologic; Historic; Recreational; Scenic	Yes (Paint Rock Creek, South Paint Rock Creek, and portion Laddie Creek 10.57 miles) No (upstream portion of Laddie Creek 0.70 miles)
Powder River (Middle Fork)	2.53	1.12	Recreational	Fish; Recreational	Yes
Trapper Creek	10.91	10.91	Wild	Cultural; Geologic; Other Values (caving area); Recreational; Scenic	Yes
White Creek	11.26	6.98	Wild	Cultural; Geologic; Scenic	Yes (downstream portion 5.72 miles) No (upstream portion 1.26 miles)

Sources: BLM 2002a; BLM 2003a; BLM 2013a; BLM 2009p.

[1]Waterway segment revaluated as part of the 2009 Cody Field Office Wild and Scenic River Addendum Report.

Note: information in columns *Total Length of Waterway Reviewed* comes from BLM 2002a, BLM 2003a, BLM 2013a, BLM 2009p. Information in column *Total Length of Segments on BLM-administered Lands* was calculated using BLM 2013a.

BLM Bureau of Land Management

Step II – Suitability Factors

The BLM reviewed all waterway segments that meet the eligibility criteria to determine if they were also suitable for inclusion in the NWSRS. The Wild and Scenic River Act and BLM Manual 6400 list a number of factors that should be considered when assessing the suitability of waterways for inclusion in the NWSRS. Along the eligible waterways, the BLM found 14 that also met the suitability factors.

Several things caused eligible waterways to not meet suitability factors, including: management conflicts and/or challenges due to adjacent non BLM-administered lands or mineral estate, and the effectiveness of current non-WSR management in protecting the identified ORVs. Refer to the WFO and CYFO WSR Reports, available on the project website, and Appendix F of this document for additional detail on the WSR evaluation process.

3.7.6 Wilderness Study Areas

In 1964, Congress passed the Wilderness Act, thereby establishing a national system of lands for the purpose of preserving a representative sample of ecosystems in a natural condition for the benefit of future generations. Until 1976, the National Park Service and the USFS managed most land considered for and designated as wilderness. With the passage of FLPMA in 1976, Congress directed the BLM to inventory, study, and recommend which public lands under its administration should be designated as wilderness. Areas identified under this direction are WSAs. To be designated as wilderness, an area must have the following characteristics:

- **Size:** roadless areas of at least 5,000 acres of public lands or of a manageable size.
- **Naturalness:** generally appears to have been impacted primarily by the forces of nature.
- **Opportunities:** provides outstanding opportunities for solitude or primitive and unconfined types of recreation.

WSAs also often have special qualities such as ecological, geological, educational, historical, scientific, and scenic values. There are no congressionally designated wilderness areas in the Planning Area.

In the late 1980s and early 1990s, Wyoming BLM drafted an EIS analyzing the impacts of managing the areas that were identified as containing wilderness characteristics after the initial wilderness inventories in the mid-1970s, and the subsequent intensive inventories in the 1980s, which includes the areas within the Bighorn Basin. The final EIS, published in 1991, included the BLM's recommendations to Congress of which areas should be managed as wilderness. As mandated by the late Interim Management Policy for Lands under Wilderness Review, which was recently replaced by BLM Manual 6330, Management of Wilderness Study Areas, the areas analyzed in the EIS are to be managed by the non-impairment standard until Congress either designates an area as wilderness or releases it back to multiple use (BLM 2012a).

There are 10 WSAs in the Planning Area (Map 93 and Table 3-56). These areas contain important natural resources, special features, naturalness, and primitiveness to support eco-based tourism. With the increase in demand for consumptive and non-consumptive resources, and an increase in development in natural and primitive areas, the WSAs have natural recreational resources that provide unique niches that are still preserved. The following paragraphs identify the locations, important features, and original inventory numbers (assigned at the time of the BLM wilderness inventory) of the WSAs in the Planning Area.

Table 3-56. Wilderness Study Areas and Acreages in the Planning Area

Wilderness Study Area	Acres
Alkali Creek	9,475
Bobcat Draw Badlands	16,969
Cedar Mountain	20,425
Honeycombs	20,156
McCullough Peaks	24,531
Medicine Lodge	7,181
Owl Creek	668
Red Butte	10,805
Sheep Mountain	23,256
Trapper Creek	7,475
Total	140,940

Source: BLM 2013a

Alkali Creek Wilderness Study Area

The Alkali Creek WSA (WY-010-241) includes 9,475 acres of BLM-administered public lands surrounding private lands totaling 680 acres. The WSA is in Big Horn County, 7 miles north of Hyattville, Wyoming, along the west slope of the Big Horn Mountains. The WSA boundaries follow Alkali and Red Gulch Roads on the east and north, and a two-track trail along the western boundary. The southern boundary follows state and private property lines and Alkali Road.

The WSA is in and represents a rare pristine example of the transition zone between the lower west slopes of the Big Horn Mountains and the floor of the Bighorn Basin. Visual and geologic resource values enhance the wilderness characteristics of Alkali Creek WSA. On the rims of the canyons, scenic vistas provide an unencumbered view of the basin floor and the majestic mountains. The WSA is known to contain pictographs, rock shelters, and other important cultural values of early occupation.

Bobcat Draw Badlands Wilderness Study Area

The Bobcat Draw Badlands WSA (WY-010-126) includes 16,969 acres of BLM-administered public land and 13 acres of state-owned land. The WSA is in Washakie and Big Horn counties, approximately 25 miles west of Worland, Wyoming. The southern, western, and eastern boundaries of the WSA follow primitive roads. The northeast boundary follows a road and then detours around a state-owned section and continues along a road to the southeast to a two-track trail, which was used as a boundary to exclude an area lacking wilderness characteristics.

The western portion of the WSA is dominated by broad, grass-covered benches or ridges separated by deep, wide drainages running into the Big Draw drainage to the north or the Fifteenmile drainage to the east. Bare, rugged desert pockets of colorful badland scenery and geologic formations like hoodoos, spires, and mushrooms are predominant in the central and southern portions of the WSA and offer

interesting attractions to recreationists. The variable terrain and the rugged, colorful badland topography offer a unique and interesting wilderness and primitive recreation setting. Human intrusions in the Bobcat Draw Badlands WSA are minor and do not have an important impact on the natural character of the area.

Cedar Mountain Wilderness Study Area

The Cedar Mountain WSA (WY-010-222) includes 20,425 acres of BLM-administered public lands with 42 acres of private or state in-holdings. The WSA is in Washakie County, 2 miles east of Kirby along the east side of the Bighorn River. Part of the eastern boundary is along a natural gas pipeline ROW, roads, and state lands property lines. The southern boundary is mainly along a road and private property boundary.

The WSA is an area of rugged topography characterized by deep, steep-sided drainages flowing north or west toward the Bighorn River. The abrupt elevation difference in the area (from 4,200 to 5,500 feet amsl), combined with the belt of junipers on the top and sides of Cedar Mountain, creates a scenic and contrasting element against the other natural elements. Cedar Mountain is the dominant visual feature of the unit. The area is unusual because of its elevation, the vegetation growing on it, and the imposing rock escarpment that forms its southern side. Visual, paleontological, and geographic resource values enhance the wilderness characteristics of Cedar Mountain WSA. The soil, rock, and vegetation colors and the area's topography contribute to the visual features. Petrified wood and reptilian fossils are found in the southern portion of the area. Mammalian fossils are found north of Cedar Mountain.

Honeycombs Wilderness Study Area

The Honeycombs WSA (WY-010-221) contains 20,156 acres of BLM-administered public lands, and 13 acres of split-estate lands. The WSA is located in Washakie County, 16 miles southeast of Worland, Wyoming. The north and east boundaries are the BLM's Blue Bank Road, state, and private lands. The southern and western boundaries are two-track trails, one section of state lands, and Nowater Creek.

The WSA consists of two land forms. A central core area is comprised of sharply eroded, strongly dissected badlands. The area around the core is rolling to steep hills. The exposures of the Willwood Formation provide opportunities to study scenic erosion patterns. The soil colors vary from reds, pinks, and purples to numerous shades of browns to tans. The Honeycombs WSA is also known to have the potential for deposits of large mammalian fossils from the Tertiary period.

McCullough Peaks Wilderness Study Area

The McCullough Peaks WSA (WY-010-335) includes 24,531 acres of BLM-administered public land and a 640 acre in-holding of state land. The WSA is in Park County, 10 miles northeast of Cody, Wyoming, and 6 miles south of Powell, Wyoming. The boundary consists primarily of roads, property lines, and a powerline ROW.

The WSA consists of the badlands that form the north slope of the McCullough Peaks. The terrain is characterized by sharp ridges and deeply eroded drainages. There also are large expanses of open, gentle terrain. The area is scenic and provides opportunities for solitude and primitive recreation. The topography, scenic vistas, and wildlife attract visitors. Nationally important paleontological resources and cultural resources are present in the area. Locals use the area for a variety of recreational activities.

Medicine Lodge Wilderness Study Area

The Medicine Lodge WSA (WY-010-240) includes 7,181 acres of BLM-administered public lands with 4 acres of private or state in-holdings. The WSA is in Big Horn County, 5 miles northeast of Hyattville, Wyoming, along the west slope of the Big Horn Mountains. The WSA is bounded mainly by Cold Springs Road on the south, Black Butte Road on the north and the west, and the Bighorn National Forest on the east.

The WSA consists of canyon walls towering 1,000 feet above Medicine Lodge Creek. The remainder of the WSA consists of steeply sloping shrub-steppe and broken rugged areas with shallow canyons and unusual knobby rock outcrops. Bighorn sheep, which were reintroduced in the Paint Rock Canyon area several years ago but no longer inhabit the area, used the Medicine Lodge WSA as summer range. Outstanding ecological values include vegetative and wildlife communities that are essentially unaffected by human activity. Exposed geologic features provide the opportunity to study the geologic history of the area. The Madison Formation is a storehouse of fossils such as branchiopods, corals, bryozoans, and crinoid stems. Medicine Lodge Canyon rates extremely high in scenic value based on its rich color combinations, and the vertical or nearly vertical cliffs, spires and formations.

The Spanish Point Karst ACEC, which maintains and protects the cave and karst system, sinking stream segments, and groundwater quantity and quality, includes portions of the Medicine Lodge WSA. The extra management efforts to maintain the ACEC, cave systems, and travel management designations greatly enhance the efforts to maintain the wilderness characteristics of the Medicine Lodge WSA.

Owl Creek Wilderness Study Area

The Owl Creek WSA (WY-010-104 a, b, c) consists of three tracts totaling 668 acres. The WSA is in Hot Springs County in the upper foothills of the Absaroka Range near a peak called Washakie Needles. The boundary of Tract a is formed by the Washakie Wilderness to the north, the South Fork of Owl Creek and the Wind River Indian Reservation to the west, Klicker Creek to the south, and private land to the east. Tract b is adjacent to the Washakie Wilderness, which forms the north boundary, and private land surrounds the rest of the tract. The east boundary of Tract c extends along Rock Creek and the Washakie Wilderness on the west. The north boundary is formed by a short segment of private property and the south boundary is along the south section line of section 31.

The landscape is dominated by a ridge line that divides the main drainages of Rock Creek and the South Fork of Owl Creek. Several steep, rugged spur ridges extend laterally from the main ridge, and are sharply separated by a number of deep side-draws that drain into the relatively wide, flat bottoms of the main drainages. Evidence of modern human activity is virtually nonexistent in the WSA. The WSA is also influenced by Upper Owl Creek Area ACEC management, which protects overlapping and important big game habitats and migration corridors, fisheries habitat, shallow soils, alpine vegetation and rare plants, diverse cultural resources and Native American traditional values, primitive recreational opportunities, and high scenic quality.

Red Butte Wilderness Study Area

The Red Butte WSA (WY-010-131) is on 10,805 acres of BLM-administered public land and is in Big Horn County, approximately 15 miles northwest of Worland, Wyoming. All boundaries, except for approximately 1.5 miles of section on the west side of the WSA, are along improved dirt roads on BLM-administered land.

The WSA contains bare, rugged badlands created by peaks and ridges broken by irregular, sharply cut drainages radiating from the central portion of the area that is dominated by Red Butte. The bare, red-hued soils of this area are highly eroded, creating a dissected, rugged landform. The northeastern portion exhibits less rugged badlands intermixed with a series of small bench-like terraces overlooking the flat drainage bottom of Fivemile Creek. The western portion of the unit consists of badlands opening up to broad, shallow drainages and flat-to-rolling plains along the drainages of Reservoir Creek and the North Fork of Fifteenmile Creek.

Sheep Mountain Wilderness Study Area

The Sheep Mountain WSA (WY-010-130) includes 23,256 acres of BLM-administered public lands and 19 acres of split-estate lands. The WSA is located in Big Horn County approximately 20 to 25 miles northwest of Worland, Wyoming, and 18 to 20 miles west of Greybull and Basin, Wyoming. State and private lands and the Burlington Pass Road form the western boundary of the WSA. The eastern boundary is along a major oil pipeline ROW and the Dorsey Creek Road. The southern boundary is located along the township line to exclude areas lacking the wilderness characteristic of naturalness and a finger of land created by roads accessing livestock management facilities. The northern boundary follows a road and an oil pipeline.

The WSA contains bare, rugged badlands created by peaks and ridges broken by irregular, sharply cut drainages radiating from the central portion of the area that is dominated by Sheep Mountain. The bare, red-hued soils of this area are highly eroded, creating a dissected, rugged landform. Sheep Mountain and the eastern-most portion of Tatman Mountain are the dominant topographic features. Sharply incised drainages radiate from these mountains and combine to form moderately broad, flat, grassy bottoms separated by rounded badland ridges along the perimeter of the unit.

Trapper Creek Wilderness Study Area

The Trapper Creek WSA (WY-010-242) includes 7,475 acres of BLM-administered public lands with 17 acres of private or state in-holdings. The WSA is in Big Horn County, 5 miles southeast of Shell, Wyoming, along the west slope of the Big Horn Mountains. The boundary along the western and northern portions follows Black Mountain Road, physical boundaries, and state and private lands. The eastern and southern boundaries are Trapper Rim Road, private land, and legal boundaries.

Trapper Creek canyon contains some of the most valuable scenery on the west slope of the Big Horn Mountains. The canyon is characterized by the dramatic vertical relief of the cliffs, with a total depth of more than 1,200 feet from the rim to the creek. Other features include spires, and massive rock outcrops of the canyon walls, a rich variety of vegetation, a clear cascading stream, and rich color combinations. There is a riparian plant community along the length of Trapper Creek. The lower entrance to Great X Cave is in the WSA. Trapper Creek landscape has scenery of exceptional quality. The Spanish Point Karst ACEC includes portions of the WSA, which maintains and protects the cave and karst system, the sinking stream segments, and groundwater quantity and quality.

Other Wilderness Study Areas

The BLM Billings Field Office in Montana also manages two WSAs that lie predominately in Montana, but include some acreage in Wyoming. Neither the CYFO nor the WFO addresses management of these WSAs.

3.8 Socioeconomic Resources

The Socioeconomic Resources topic includes the individual resources of social conditions, economic conditions, health and safety, environmental justice, and tribal treaty rights. Each individual resource section provides a description of the resource and the current condition of the resource.

3.8.1 Social Conditions

Social conditions concern the human communities in the Planning Area, including towns, cities, and rural areas, and the custom, culture, and history of the area as it relates to human settlement, as well as current social values.

This section discusses population and demographics, custom, culture, and social trends. For information on the history of human settlement in the Planning Area, see Section 3.5.1 *Cultural Resources*.

Population and Demographics

Table 3-57 provides a summary of population for the Planning Area counties in 1970 and 2012, and Table 3-58 provides information on population in individual towns in the Planning Area. The most populous county in the Planning Area is Park County, with about 28,700 residents. Big Horn County contains approximately 11,800 residents, Washakie County contains approximately 8,500, and Hot Springs County contains approximately 4,800. The most populous cities in the Planning Area, in order of decreasing population, are Cody (Park County), Powell (Park County), Worland (Washakie County), Thermopolis (Hot Springs County), and Lovell (Big Horn County). Figure 3-18 provides additional detailed trend information for county populations from 1970 through 2012. The figure shows population generally increased from 1970 to the early 1980s in all four counties within the Planning Area, then generally declined through the mid to late 1980s. In Park County, population increased steadily from about 1990 to the present day. In Big Horn County, population remained relatively constant during the same period with a slight growth trend since 2005. In Hot Springs and Washakie counties, population decreased slightly from 1990 levels, particularly from the late 1990s to 2005.

Table 3-57. Population Change by County, 1970-2012

Area	Population in 1970	Population in 2012	Change 1970-2012	Average Annual Change 1970-2012
Big Horn County	10,264	11,794	15%	0.33%
Hot Springs County	5,023	4,822	-4%	-0.10%
Park County	17,805	28,702	61%	1.14%
Washakie County	7,557	8,464	12%	0.27%
State of Wyoming	333,795	576,412	73%	1.31%
United States	203,798,722	313,914,040	54%	1.03%

Sources: BEA 2010a; U.S. Census Bureau 2012; U.S. Census Bureau 2013a.

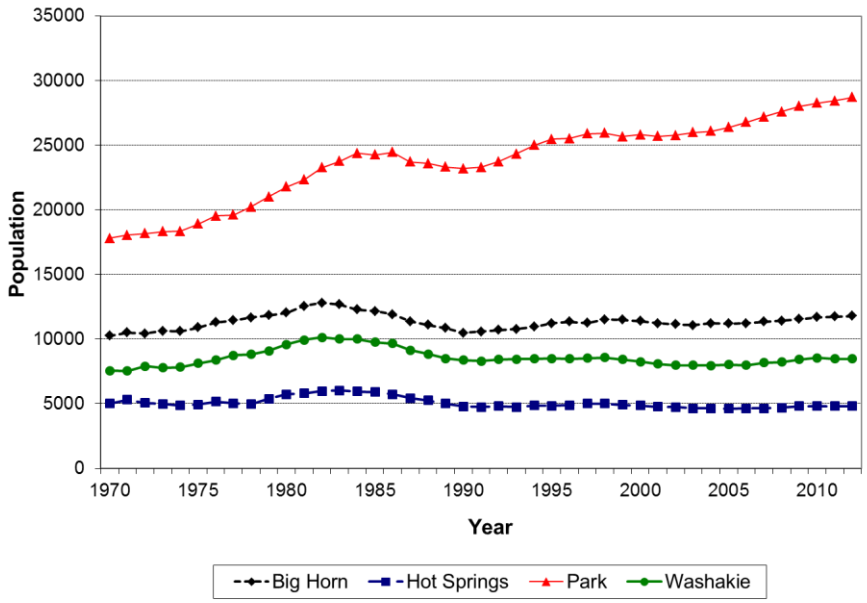
Table 3-58. Population of Towns in 2000 and 2012

Town	Population in 2000	Population in 2012	Change 2000-2012	Average Annual Change 2000-2012
Big Horn County	11,461	11,794	3%	0.2%
Basin	1,243	1,292	4%	0.3%
Burlington	250	309	24%	1.8%
Byron	557	599	8%	0.6%
Cowley	560	694	24%	1.8%
Deaver	177	182	3%	0.2%
Frannie[1]	209	161	-23%	-2.2%
Greybull	1,815	1,853	2%	0.2%
Lovell	2,361	2,381	1%	0.1%
Manderson	104	115	11%	0.8%
Hot Springs County	4,882	4,822	-1%	-0.1%
East Thermopolis	274	253	-8%	-0.7%
Kirby	57	93	63%	4.2%
Thermopolis	3,172	3,019	-5%	-0.4%
Park County	25,786	28,702	11%	0.9%
Cody	8,895	9,689	9%	0.7%
Meeteetse	351	330	-6%	-0.5%
Powell	5,367	8,308	55%	3.7%
Washakie County	8,289	8,308	0%	0.0%
Ten Sleep	304	264	-13%	-1.2%
Worland	5,289	5,569	5%	0.4%
State of Wyoming	493,782	576,412	17%	1.3%

Sources: U.S. Census Bureau 2000; U.S. Census Bureau 2013a.

[1]Includes portions of Frannie in both Big Horn and Park counties.

Figure 3-18. Population Trends by County, 1970-2012



Sources: BEA 2010a; U.S. Census Bureau 2013a; U.S. Census Bureau 2013b.

Table 3-59 presents information about the population distribution by various age groups in 2012. The table shows the median age was higher in all four Planning Area counties than in the state or nation, and was highest in Hot Springs County. The percentage of people aged 65 and over is higher in all four counties than the state or national average. However, in Big Horn and Washakie counties, the percentage of people under 18 was slightly higher than the national and state averages; in these counties, relatively low percentages of people aged 18 to 44 is reflected in the higher median age. In Hot Springs and Park counties, there is also a relatively low percentage of people under the age of 18, as well as a relatively low percentage of people aged 18 to 44.

Table 3-59. Age Distribution by County, 2012

Area	Median Age	Percent of People by Age Category				
		Under 18	18-24	25-44	45-64	65 and Over
Big Horn County	41.8	25%	8%	21%	28%	19%
Hot Springs County	49.2	19%	6%	20%	32%	23%
Park County	43.9	21%	9%	22%	30%	19%
Washakie County	42.0	25%	6%	22%	28%	19%
State of Wyoming	36.9	24%	10%	26%	27%	13%
United States	37.4	23%	10%	26%	26%	14%

Source: U.S. Census Bureau 2013c

Table 3-60 shows the same data for the year 2000, which helps establish the trend over time. The year 2000 and 2012 comparison shows that the population in all four counties is growing older, with an increasing median age and the expected changes in each age category (a smaller proportion of people in the younger categories, and a larger proportion in the older categories, in 2012 compared with 2000). At the national level, an aging population can create economic problems such as how to fund Social Security. At the local level, an aging population could reduce the supply of labor, particularly of young workers entering the labor market at relatively lower wages. Another concern would be that there would likely be an increased demand for hospital services; to the degree that people on fixed incomes contribute less to local tax revenues, this can create an imbalance of local government revenues and expenditures.

Table 3-60. Age Distribution by County, 2000

Area	Median Age	Percent of People by Age Category				
		Under 18	18-24	25-44	45-64	65 and Over
Big Horn County	38.7	29%	7%	23%	25%	17%
Hot Springs County	44.2	22%	6%	23%	29%	20%
Park County	39.8	24%	9%	25%	27%	15%
Washakie County	39.4	27%	6%	25%	25%	16%
State of Wyoming	36.2	26%	10%	28%	24%	12%
United States	35.3	26%	10%	30%	22%	12%

Sources: U.S. Census Bureau 2009a; U.S. Census Bureau 2009b; U.S. Census Bureau 2010a; U.S. Census Bureau 2010b; U.S. Census Bureau 2010c.

Table 3-61 provides a summary of educational attainment in each county within the Planning Area in 2011. The table shows that the percentage of high school graduates is comparable to the statewide level in all four Planning Area counties, and higher than the national average. Only Park County, however, has a level of 4-year college graduates that equals or exceeds the state or national average.

Table 3-61. Educational Attainment in 2011

Area	Percent of people age 25 and over:	
	With a high school diploma	With a 4-year college degree
Big Horn County	90%	19%
Hot Springs County	88%	20%
Park County	93%	28%
Washakie County	89%	23%
State of Wyoming	92%	24%
United States	85%	28%

Source: U.S. Census Bureau 2011a

Table 3-62 shows data on gender distribution by counties. Gender distribution is very close to 50 percent male and 50 percent female in all four counties.

Table 3-62. Gender in 2010

Area	Percent of people who are:	
	Male	Female
Big Horn County	50%	50%
Hot Springs County	49%	51%
Park County	50%	50%
Washakie County	50%	50%
State of Wyoming	51%	49%
United States	49%	51%

Source: U.S. Census Bureau 2013c

Because people of all ages and all levels of educational attainment, and both men and women, use BLM lands, the variation in these demographic groups is not a driver for BLM's management actions in the Planning Area. However, the demographic data provides a backdrop of the human communities that will be affected by BLM's decisions.

Transient and Seasonal Populations

Another demographic variable of interest relates to the transience and permanence of populations. Table 3-63 shows data from the 2000 Census on where people lived 5 years prior to the Census (i.e., in 1995). The data show the population of the study area counties is relatively stable: in all four counties, over half of the residents lived in the same residence 5 years prior, and about 75 to 80 percent of the residents lived in the same county. These percentages, which are comparable to state and national averages, show a substantial degree of stability in the population.

Table 3-63. Residence in 1995, as Tabulated in 2000

Residence	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming	United States
Same house	58%	54%	51%	59%	51%	54%
Different house, same county	19%	21%	23%	20%	24%	25%
Different county, same state	9%	11%	8%	11%	8%	10%
Other location	14%	14%	18%	10%	17%	11%

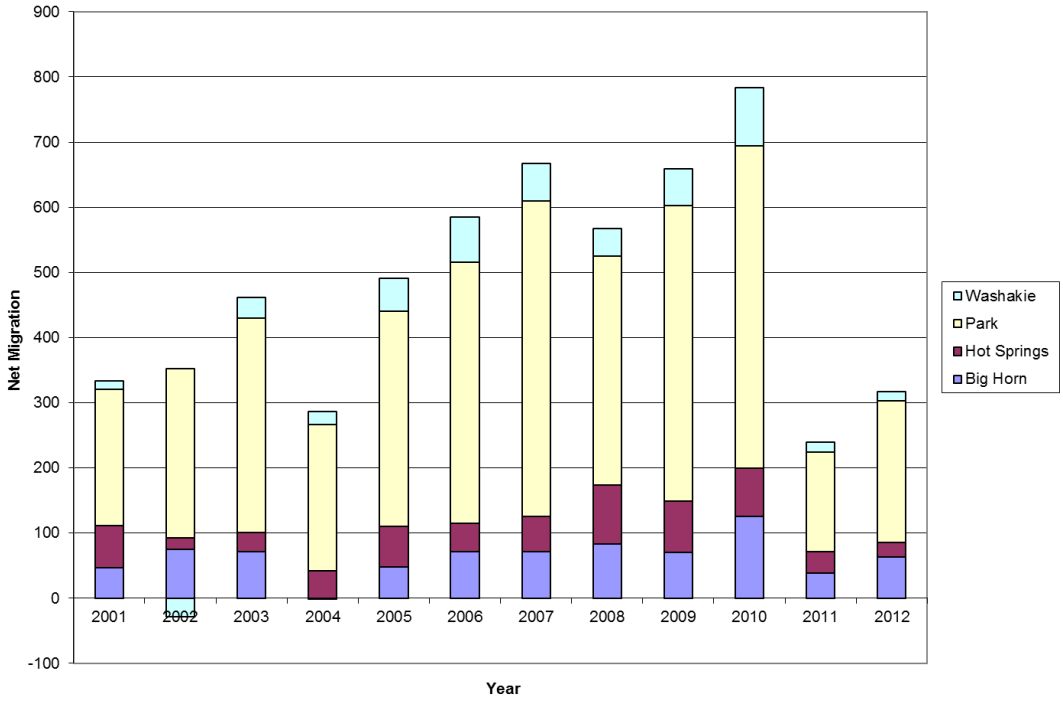
Source: U.S. Census Bureau 2000

The Wyoming Housing Database Partnership (WHDP 2013) analyzed data from driver's license exchanges to show the net movement of people into and out of the state. This data is more current than the Census data, and also shows the magnitude of net movements. The data account for people who transfer licenses from another state to Wyoming, and those who cancel their Wyoming license because they have moved out of state; however, it only tracks people with licenses, meaning that it does not include children. This analysis showed a net gain of about 56,000 people statewide from 2000

through the first half of 2012. The modal (i.e., most common) age bracket for in-migrants is between age 26 and 45. Driver's license transfer data shows that most individuals are coming from other western states and Michigan, with California accounting for the single largest share (about 21 percent).

The Wyoming Housing Database Partnership analysis shows that the largest share of migrants to the State of Wyoming from 2001-2012 moved to places other than the Planning Area. The counties that received the largest share of migrants are Laramie (15 percent), Campbell (12 percent), Natrona (11 percent), and Teton (9 percent). By comparison, Park County received 7 percent of the migrants (about 3,900 people from 2001 through 2012), and Big Horn, Hot Springs, and Washakie counties received between 0.8 and 1.4 percent each (761 people in Big Horn, 614 in Hot Springs, and 432 in Washakie, for a total of about 1,800 people). Figure 3-19 shows the trend of migration over time.

Figure 3-19. Net Migration 2001-2012



Sources: WHDP 2009a; WHDP 2013. Based on driver's license exchanges.

Note: In 2002, net migration to Washakie County was negative. In 2004, net migration to Big Horn County was negative.

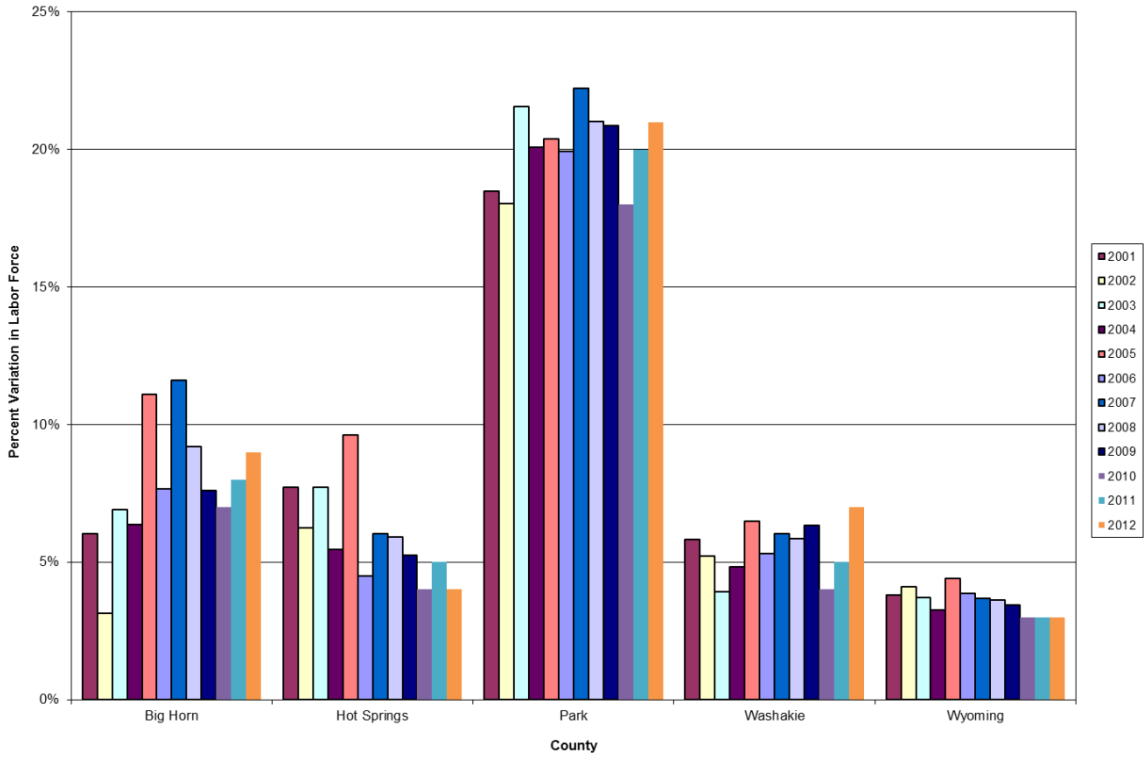
A common method for examining the degree of transience in the workforce is to analyze the variation in employment over a given year. If the size of the labor force (i.e., people with jobs or seeking jobs) does not change much over the year, this suggests the employment base is quite stable and few people move to the area on a temporary or seasonal basis to look for jobs. On the other hand, a relatively high magnitude of fluctuation in the labor force suggests an area undergoing change that is often marked by people moving temporarily from one area to another to seek employment.

Figure 3-20 shows the relative variation in the labor force for each county from 2001-2012. For each year and county, the values in the figure represent the difference in magnitude of the highest-month labor force versus the lowest-month labor force ("peak-to-trough"), divided by the average size of the labor force. For instance, in Park County in 2012, the labor force in the highest month (July) was 17,800,

in the lowest month (February) was 14,500, and the average for the year was 15,757. Thus, the relative variation in the labor force in Park County in 2007 was (17,800 – 14,500) / 15,757, or about 21 percent of the labor force (BLS 2013).

The figure shows that labor force fluctuations are greatest in Park County (between 20 and 22 percent of the labor force). Labor force fluctuations represent a smaller portion of the average labor force in Big Horn and Hot Springs counties (typically 5 to 10 percent) and Washakie County (about 5 percent). Labor force variations in Wyoming are typically on the order of 3 to 4 percent. Note, however, that the labor force variation at the county level includes people who move temporarily from one county to another seeking work (e.g., people who move from Laramie County to Park County seeking summer work would be included in the Park County labor force fluctuation, but not the statewide labor force fluctuation). For this reason, county-level variation is almost always greater than state-level variation.

Figure 3-20. Labor Force Variation, 2001-2012



Source: BLS 2013

Together, the three data sources presented above indicate that the residential population is quite stable, with about 75 to 80 percent of people who lived in the counties in 2000 having lived within the same county for at least 5 years. The Planning Area seems to attract net in-migration based on the driver's license exchange data, with Park County attracting the most by far. Seasonal variation in the labor force is largest in Park County and somewhat smaller in the other three counties. Because the highest labor force occurs in the summer months and the lowest in the winter months, it is reasonable to assume that most of the summer-month additional employment is related to outdoor work, either directly (e.g., outdoor guides) or indirectly (e.g., hotel workers supported by increased tourism). BLM management actions that affect the quality of and access to recreational resources, livestock grazing,

and oil and gas development areas therefore will affect the transient workforce as well as the permanent residents within the Planning Area.

Having a high proportion of transient workers can result in both beneficial and adverse effects on the social fabric of a community. Transient workers pay local sales taxes when they purchase goods and services, and help local business people by providing both a temporary workforce when needed and a consumer base for retail activity. They also fill rental housing, which helps landlords. However, transient workers can also contribute to social instability. If BLM actions were to contribute to an increase or reduction in the size of the transient workforce, whether this would be viewed as a beneficial or adverse impact would depend on individual perspective. Similarly, the fact that Park County is gaining population and attracting substantial in-migration is likely viewed as beneficial by some residents and adverse by others.

3.8.1.1 Custom, Culture, and Social Trends

This section describes the social development, culture, and history of the Planning Area to provide insight into how changes to the Planning Area might affect the livelihood and quality of residential life. The section addresses the history of human settlement in the Planning Area, with a particular focus on economic and social development; land use plans within the counties, focusing on issues the counties have identified that relate to new or planned infrastructure; and "non-market" economic and social values.

Economic and Social History

Throughout the history of the Planning Area, the use of natural resources on private, state, and federal land has provided the basis for continued social and economic stability in all four counties. Agriculture, mining, mineral development and production, and tourism are directly tied to the ability to use federal and state land. As a result, management decisions for federal (and state) land and natural resources will have a ripple effect throughout the social and economic climate of the Planning Area.

The communities of the Bighorn Basin emerged from ranching and agricultural centers; mining or oil field camps; stop over places between two larger communities; or unique recreational features, such as Thermopolis' hot springs. In general, the factors that contributed to the emergence of these communities are still evident and important in their current identities. Public lands and the policies exerted considerable influence on the formation of the communities in the Bighorn Basin and continue to play a large role in their social and economic fabric. The major uses of public land in these communities, both past and present, are open range grazing, development of irrigation waters, mining of minerals, drilling for oil and gas, and recreation.

The first known occupants of land in the Planning Area are members of various Native American tribes, including Shoshone, Crow, Blackfeet, A'aninin (Gros Ventre), Arapaho, Sioux, and Tsitsistas (Cheyenne) tribes. The first recorded European-American to enter the Bighorn Basin was John Colter, a member of the Lewis and Clark Expedition, who arrived in 1806 (Washakie County 2012). Other explorers and fur traders followed in the early and middle 1800s (Washakie County 2012, Hot Springs County 2002). Intensive European-American settlement began to occur to the 1870s and 1880s, primarily due to the development of cattle ranches and homesteads (Hot Springs County 2002).

By 1884, the Bighorn Basin was well stocked with cattle. From the time cattle ranches started in the Basin until the Extended Homestead Act of 1909 and the Taylor Grazing Act of 1934, most of the area was open grazing. During this open range period, range wars were common as large scale ranchers vied for control of the area. With passage of the Homestead Act, the range was divided and large ranchers

would homestead, using various methods, to ensure access to water sources and to landlock public lands with their own lands. The Taylor Grazing Act established grazing permits to combat range wars and overgrazing.

A number of factors contributed to the rapid deterioration of western agricultural lands during the early 1930s. The application of poor farming procedures, misuse of range, and extreme lack of moisture were probably foremost in creating these adverse conditions. Recognizing the need to stop further degradation of these valuable lands, Senator Earl Bower, of Washakie County, introduced a bill establishing the Wyoming Soil Conservation Act in February 1941. This Act authorized the establishment of Soil Conservation Districts. These newly formed bodies were given the responsibility of natural resource conservation within their respective districts. As more resource conflicts arose, the role of conservation districts continued to expand. With the enactment of Federal Land Policy and Management Act of 1976, which included the term "multiple use" management and defined it as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people," the role of the conservation districts became even broader. Acting as local governments, the conservation districts strived to ensure sustainable use and conservation of local resources.

After the arrival of the cattle in the Basin, irrigation projects furthered the development of the Bighorn Basin. There have been both public land projects and private projects; however both have relied on access to public lands. The first attempt at large-scale irrigation using the waters of the Bighorn River in the southern portion of the Planning Area was first made in 1886. A group dug a diversion ditch about four miles south of Worland. However, no crops were grown as a result of this effort (Washakie County 2012). In what is now Park County, Colonel William F. "Buffalo Bill" Cody and some business partners established the Shoshone Irrigation Corporation in 1894. The federal government took over the project and began construction in 1904. The first water was available for irrigation in 1908, in the vicinity of Powell.

Development of the Shoshone Project continued through 1947 and provided irrigation water and other benefits to an increasing area of the Bighorn Basin. In addition to irrigation, the project provides hydroelectric power, recreation opportunities in the Buffalo Bill Reservoir, and flood control. The U.S. BOR and other governmental agencies also dug several large ditches around Worland, and eventually developed the Boysen Reservoir to provide reliable irrigation water in Washakie County (Washakie County 2012).

Private irrigation developments, such as the Sidon canal, the Lower Shoshone River irrigation, the Greybull River system, and developments along the creeks coming out of the Big Horns, cover as much or more of the Basin than federal irrigation projects. These private irrigation projects depended on availability of federal land to start, and still depend on federal land or involvement in many ways (Kelso pers. comm.). Today, the Bighorn Basin is one of two irrigated cash crop regions in Wyoming, the other being Goshen and Platte Counties (Big Horn County 2009).

At about the same time as the construction of the irrigation projects, the railroad was also being developed through the Bighorn Basin. In 1906 the Chicago, Burlington, and Quincy railroad was completed. The railroad brought various changes, including the physical movement of the town of Worland from the west to the east side of the Bighorn River (Washakie County 2012).

Eight years after the completion of the railroad an "oil rush" in the Bighorn Basin started with the discovery of the Grass Creek Field in 1914. Grass Creek, Little Buffalo Basin and Elk Basin were all established as commercially important oil fields. The Hidden Dome field, which was discovered in 1917, was the earliest major oil field in Washakie County (Washakie County 2012). Petroleum quickly became

a central economic contributor: for instance, by 1916, 70 percent of the property taxes in Hot Springs County were paid by oil.

County and District Land Use Plans

The county and conservation district land use plans highlight the continued importance of the interrelationship between the local communities and public lands. The continued ability to pay to lease public lands is vital to the industries that create stability within the communities. Each county and associated conservation district is described briefly below and portions of their Land Use Plans are included to demonstrate the interconnectedness of their communities and public lands. In addition, the information below includes some county-specific history (in addition to the overall Planning Area history presented above) to provide context for the county and district land use plans.

All four counties in the Planning Area have comprehensive land use plans that address existing and planned or hoped-for future conditions of community infrastructure and other elements. The land use plans for the counties contain abundant information about policies and goals affecting development of industrial, residential, and commercial infrastructure, but they all generally support the continuation of balanced economic development along with the preservation, to the degree possible, of natural landscapes, wildlife habitat, and open space (Hot Springs County 2002; Hot Springs County 2005; Big Horn County 2009; Washakie County 2012; Park County 1998).

Big Horn County, Shoshone Conservation District, and South Big Horn Conservation District

Big Horn County, in the northeastern portion of the Bighorn Basin, is the oldest of the four counties in the Bighorn Basin. When it was originally formed in 1890 from portions of Fremont, Johnston, and Sheridan counties, it contained the entire Bighorn Basin. Portions were carved out to create Park County in 1909 and Washakie and Hot Springs Counties in 1911. Out of the four counties, Big Horn County has the largest number of small communities (Big Horn County 2009). There are thirteen communities, nine incorporated towns, and four unincorporated towns. The nine incorporated towns are: Basin, Burlington, Byron, Cowley, Deaver, Greybull, Frannie, Lovell, and Manderson. The largest community is the town of Basin, which is the county seat.

In 1879 Otto Franc brought a herd of cattle to the Greybull River Valley, about the same time Henry T. Lovell trailed two herds to the No Wood area. In 1881 John Luman trailed a herd to the Paint Rock Area (Grant pers. comm.). In 1895, the first irrigation project under the Carey Act was started on the Greybull River by the Bighorn Basin Development Company. The towns of Burlington and Otto were established that same year. In the spring of 1900, the Big Horn Colonization Company was formed and in the summer of 1900, construction of the Sidon Canal began and the town sites of Byron, Cowley, and Lovell were formed. Buffalo Bill Dam in Park County, completed in 1910, provided a more reliable source of water for irrigation.

The flanks of the Big Horn Range are one of three areas of bentonite production in Wyoming. With Wyoming containing 70 percent of the world's bentonite, this industry is economically important to Big Horn County, the state of Wyoming, and the nation. Wyo-Ben is one of the region's bentonite producers and provides an example of the impact that public land use of the industry has on the local communities. Wyo-Ben's first plant went into production in 1951 at Greybull. The Lovell plant opened in 1970. Thermopolis, in Hot Springs County, opened in 1980, but has operated only intermittently until recently. Their claims (which include BLM lands) go back to the 1940s. The Greybull plant directly employs 57 people, the Lovell plant employs 30, and Thermopolis employs 23. Mining is all by contract through GK Construction, which provides mining services for several bentonite companies (Magstadt

pers. comm.). In addition to direct employment and contract services, there are general construction contractors, environmental contractors, and others who provide services to the industry intermittently.

The Big Horn County plan, which was adopted in January 2010, suggests that the county's physical infrastructure is generally adequate for the relatively slow pace of development that the county expects in the near future. For instance, discussing water supply and distribution infrastructure in detail for each of the county communities, the plan concluded that while localized problems such as undersized or antiquated water lines can hamper development in specific locations, overall supplies are adequate for the future (Big Horn County 2009). Similarly, the plan notes that electricity, high-speed internet, telephone, and cable television are available for every incorporated community, though not for all homes in unincorporated areas. The plan does note the need to protect its agricultural industry, for instance by adjusting county land use programs and policies to support sustained agricultural profitability. The plan notes an increase in the number of hobby farms and ranchettes and notes that these operations may not have the same level of profitability of larger operations, and may compete with larger operations for the same land and water resources. However, the plan notes, these operations do contribute to the agricultural character of the county (Big Horn County 2009). The Big Horn County land use plan also identifies a need to diversify the region's economy, as it relies relatively heavily on mining and public sector activities: education, government, and health care (Big Horn County 2009).

There are currently two conservation districts in Big Horn County, the Shoshone Conservation District and the South Big Horn Conservation District. The initial conservation districts in each of these areas were established in 1945. The Shoshone Conservation District is located in the Northern Portion of Big Horn County. The Shoshone Conservation District's 2006-2011 Land Use Plan describes the natural resources of the area and the importance of conserving natural resources for the stability of the economy. The Land Use Plan states that most of the rangeland in the district is controlled by the BLM and USFS, and ranchers are authorized grazing use through a grazing permit/lease. Therefore, continued access to these grazing lands is crucial to the economic viability of the ranch operations (Shoshone Conservation District 2005). The Land Use Plan also states the importance of wildlife to recreation (hunting and wildlife observation) and thus to economic conditions in the district. In addition, the presence of bentonite, oil, natural gas, gypsum, and uranium have contributed significantly to the economy of Big Horn County (Shoshone Conservation District 2005).

The South Big Horn Conservation District's 2007-2012 Land Use Plan explains that over 80 percent of the land within the district is federal land (South Big Horn Conservation District 2006). The Land Use Plan also states: "Generally, the Big Horn Basin is an economically depressed area of the state with agriculture, mining, oil and gas development and limited industry the primary land uses within the district. Cattle and sheep, sugar beets, malt barley, alfalfa seed and hay are the main crops produced here. Mineral production consists of mining of gypsum, gravel and bentonite. Recreation-based tourism, including hunting and fishing, is of great importance too."

Hot Springs County

Located in the southern portion of the Bighorn Basin, and formed in 1911, there are three main communities in Hot Springs County: Thermopolis, East Thermopolis, and Kirby. Hot Springs County is named for the hot springs located in Hot Springs State Park, which was Wyoming's first state park, established in 1897.

Mineral production has played a significant role in the culture and economy of Hot Springs County, starting with the discovery of coal in the late 1800s and of crude oil in the early 1900s. At one time, coal production was an important component of economic activity: the largest town in the county in 1920,

Gebo (population over 2,000), was the major work camp for coal mines in the northern portion of Hot Springs County (Wyoming Tales and Trails no date). However, the coal market collapsed after World War II with the advent of diesel-powered locomotives. By 1960, most of Gebo was abandoned. It has since been mostly demolished in an attempt to restore the land to its original condition (Hot Springs County 2002). Today, Hot Springs County produces a very small amount of coal, and none of the other counties produce any; however, petroleum production continues to this day in all four counties. The 2002 land use plan for the county indicated that crude oil production accounted for more than two-thirds of assessed county valuations since 1977 (Hot Springs County 2002).

The Hot Springs County plan notes a number of issues related to present and future desired infrastructure, including the need to develop an industrial park and a new airport to attract greater diversity of industries (Hot Springs County 2005). The plan also expresses concern about growing federal and state regulation, including on public lands, which may slow or hinder economic development. The plan also specifically identifies several needs for new or improved public infrastructure. These include improved hospital services, motivated partly by the need to ensure that the aging county population has access to excellent health care; enhancement of highways to promote recognition of historical and cultural landmarks (although the plan notes that the physical condition of government roads in the county is generally excellent); improved public transportation; and the development of a new airport, funded substantially by state and federal contributions (Hot Springs County 2005).

Park County, Cody Conservation District, Meeteetse Conservation District, and Powell-Clarks Conservation District

Park County, in the northwestern portion of the Bighorn Basin, is so named because most of Yellowstone National Park is located within its boundaries; Yellowstone National Park became the first national park in 1872. The county was formed in 1909 from portions of Big Horn County and communities of Park County, including Cody, Powell, Frannie, Meeteetse, Garland, and Ralston.

One of the purposes of Park County's Land Use Plan is to "Establish policies for greater County involvement in public land use decision making" (Park County 1998). Under the public land section, the plan notes that "The economy and aesthetic environment of Park County are dependent largely on its public lands, which comprise 85 percent of the county."

The Park County plan focuses primarily on goals and policies related to planning and, compared to the other county land use plans in the area, does not have as great a focus on identifying specific needs for physical infrastructure. However, the Park County plan does identify some key policies as being important for future planning, such as the revision of subdivision procedures and standards to facilitate minor subdivisions (i.e., those smaller than 35 acres). The plan also recommends various policies to promote the county's assets, such as incentives to developers to design projects that preserve scenic views (Park County 1998).

There are currently three conservation districts in Park County. The Cody Conservation District contains the western half of the county and the central portion of the eastern half of the county (Cody Conservation District 2007). The Meeteetse Conservation District (MCD) is located in the southeast portion of the county and the Powell-Clarks Fork Conservation District is in the northeast portion of the county (Powell-Clarks Fork Conservation District 2006). The MCD recently completed their Land Use Management and Resource Conservation Plan. This plan is intended to be a guide for the citizens of the MCD, and others, for identifying and respecting the customs, culture, economic viability, social stability and quality of life found in this unique area (Meeteetse Conservation District 2011).

One of the stated goals in the Meeteetse Conservation District Land Use Plan is to "support an agribusiness and agricultural science perspective for individual agricultural producers, agricultural communities and other agricultural entities, and other stakeholders involved with governmental agencies in the process of natural resource management and planning in order to provide for the economic and social stability of the MCD, the region, and the State of Wyoming." This goal is supported by the policies of the Plan, one of which is to "facilitate efforts to bring together individual agricultural producers, agricultural communities and other agricultural entities, other stakeholders, and governmental agencies to view natural resource management and planning from an agribusiness and agricultural science perspective in order to provide for the economic and social stability of the MCD, the region, and the State of Wyoming" (Meeteetse Conservation District 2011).

With respect to mining and the mineral industry, the MCD "recognizes the importance of the mineral industry, especially oil and gas, to its tax base and economy," including employment, flows of services and consumables, and custom and culture (Meeteetse Conservation District 2011).

With respect to culture and economic stability, the Plan states that "The economic stability of the MCD rests upon continued multiple use management of the federally or state managed lands…. The MCD relies on a one mill tax levy. While Park County and the town of Meeteetse receive a share of sales tax receipts, the MCD does not." The MCD Land Use Plan states that because the amount of private property is limited (approximately 23 percent of the county in 2008), the continued vitality of the private tax base depends upon continued multiple use of federal and state lands. The MCD Land Use Plan expresses concern that "if multiple use is restricted, business income will suffer and sales and property taxes will be affected. If grazing is restricted, financial pressure will be placed on the rancher, which may even result in his going out of business. When that happens, the tax base of the County suffers, and the business income is also reduced" (Meeteetse Conservation District 2011).

Washakie County and Washakie County Conservation District

Washakie County, formed in 1911, has two main communities, Worland and Ten Sleep. Worland is primarily a farming community and is the principal population center within Washakie County (Washakie County Conservation District 2010). However, the main source of revenue for Worland comes from oil and gas production on BLM lands. In 1903, a pioneer camp was established and Charles H. Worland selected the location as a halfway point between Basin City and Thermopolis and was an overnight stop for stagecoaches and freighters and provided them with supplies (Dietz pers. comm.).

Ten Sleep is primarily a ranching community whose ranchers utilize BLM lands for grazing in Washakie County, and also Big Horn, Hot Springs, and Park Counties. The first permanent settlement of the Ten Sleep area was around 1880 by cattlemen. The first large herds of cattle were brought in to the area by a group of local ranchers in 1886. During the 1890s, large numbers of sheep were brought into the area (Dietz pers. comm.).

Infrastructure needs identified in the Washakie County land use plan include several transportation related improvements, such as improvement of the Worland airport and upgrades to U.S. Highway 16; improved health care facilities; enhanced infrastructure for recreational opportunities; and improved infrastructure to accept the increasing amount of septic waste, due to increased residential construction in unincorporated areas. The plan also describes the recent history of the county's development, noting that the boom years of the late 1970s and early 1980s brought a steady increase in per capita income, and a number of rural subdivisions were laid out in response to the County's rapid growth. Since the boom years, the county's growth has been slower and the county has especially lost population between the ages of 25-34, which has resulted in lower school enrollment levels as well as an

increasingly aging population. This aging demographic, along with other trends, has resulted in static home values, which also affects the local tax base (Washakie County Conservation District 2010).

The Washakie County Conservation District was formed from two of the oldest conservation districts in Wyoming – Nowood Soil Conservation District, established in 1941, and Washakie County Conservation District, established in 1943. The Washakie County Conservation District 2010 Natural Resource Land Use Plan highlights the interrelationship between BLM public lands and the private landowners in the community (Washakie County Conservation District 2010). The plan states that "The County's custom and culture has been significantly influenced by the relationship of the citizenry to public land, and the economic benefits that derive from public land. The public lands and the rights and privileges residents have come to rely on in all of the public lands, are central to the custom and culture of the WCCD. The WCCD finds public land and natural resources management practices are both relevant and substantive to its custom and culture, its economy, its environment, its quality of life, and its ability to protect and enhance local resources in spite of potentially detrimental outside influences."

The plan describes a 1994 report prepared by the Department of Agricultural Economics of the College of Agriculture at the University of Wyoming on the economic contributions of the federally managed lands within the four county region of Johnson, Big Horn, Sheridan, and Washakie counties. As described in the plan, the report "…provided an in-depth view of the economic and fiscal interdependencies coexisting among the private land-users and public land-managers and the local governments. The report analyzed the economic effects of federal lands grazing, timber production, mineral development, and production of (oil, natural gas, bentonite, coal and uranium, mining and production of sand and gravel), irrigation water/crop value, tourism, and historical and recreational industries. The summaries of each section of the report provides the reader with an undeniable vision of the direct and indirect negative economic effects of reduced grazing opportunities and oil/gas seismic, exploration, development, and production opportunities. The report also depicted a continued reliance on the overall price controlled irrigated agricultural industry." The land use plan concludes that the "use of public lands for grazing, mineral development and other multiple uses by the Cooperators of the WCCD must be continued or steadily increased in the WCCD to sustain a viable natural resource and economic/fiscal future for the cooperators of the WCCD" (Washakie County Conservation District 2010).

Understanding land use plans in the counties and conservation districts is important for BLM's decision making in the RMP process, in part because federal law (43 CFR 1610.3) requires the BLM to prepare plans that are consistent with officially adopted local land use plans (to the extent consistent with federal laws and policies), identify inconsistencies with proposed BLM plans and local plans to the Governor, and take practical steps to resolve conflicts between federal and local plans. These requirements apply only if local governments notify BLM that a local land use plan has been adopted.

Population Forecasts

The Wyoming Economic Analysis Division (Wyoming Economic Analysis Division 2011) provides forecasts of population for Planning Area counties and some towns (Table 3-64). The data suggest that Park, Hot Springs and Washakie counties are all expected to grow at a 0.6 percent annual rate, and Big Horn will grow at a slightly slower rate of 0.4 percent a year.

Table 3-64. Population Forecasts through 2030

Area	Population (Actual or Forecasted)				Change 2012-2030	
	2010	2012	2020	2030	Overall	Average Annual
Big Horn County	11,668	11,794	12,350	12,740	8%	0.4%
Basin	1,285	1,292	1,360	1,403	9%	0.5%
Burlington	288	309	305	314	2%	0.1%
Byron	593	599	628	647	8%	0.4%
Cowley	655	694	693	715	3%	0.2%
Deaver	178	182	188	194	7%	0.4%
Frannie[1]	157	161	167	173	7%	0.4%
Greybull	1,847	1,853	1,955	2,017	9%	0.5%
Lovell	2,360	2,381	2,498	2,577	8%	0.4%
Manderson	114	115	121	124	8%	0.4%
Hot Springs County	4,812	4,822	5,310	5,390	12%	0.6%
East Thermopolis	254	253	280	285	13%	0.7%
Kirby	92	93	102	103	11%	0.6%
Thermopolis	3,009	3,019	3,320	3,370	12%	0.6%
Park County	28,205	28,702	30,440	32,080	12%	0.6%
Cody	9,520	9,689	10,274	10,828	12%	0.6%
Meeteetse	327	330	353	372	13%	0.7%
Powell	6,314	8,308	6,814	7,181	-14%	-0.8%
Washakie County	8,533	8,308	9,130	9,240	11%	0.6%
Ten Sleep	260	264	278	282	7%	0.4%
Worland	5,487	5,569	5,871	5,942	7%	0.4%
State of Wyoming	563,626	576,412	622,360	668,830	16%	0.8%

Sources: U.S. Census Bureau 2013a; Wyoming Economic Analysis Division 2011.

[1]Includes portions of Frannie located in Big Horn and Park counties.

Non-Market Economic and Social Values

Consistent with the social, economic, and cultural development of the area, many residents of the Planning Area continue to place high value on the open spaces and vistas, continuing operation of farms and ranches, livestock grazing, and the wide variety of recreational opportunities available in and near the Planning Area. Based on the information in county land use plans as well as the scoping comments the BLM has received during the RMP revision process, the value of these features may not be fully represented in the marketplace. There is thus a reasonable argument for the consideration of "non-market values" in the analysis. Well established in economic theory, non-market values refer to the "utility" or "happiness" that people obtain from tangible or intangible goods or services, but that is not reflected in the market price of those goods or services. Non-market values include some forms of direct use – whether consumptive, such as recreational fishing and hunting, or non-consumptive, such as hiking, boating, wildlife viewing, and viewing scenic vistas. Non-market values also include "indirect"

values, such as ecosystem services that support ecological resources, and "non-use" values, which include altruistic values (for others' enjoyment), bequest values (for the ability of future generations to use the resource), and existence values (satisfaction from knowing that a resource exists, independent of any predicted use of the resource by any human being).

The scoping comments from the RMP and EIS process suggest that non-market values are an important component of value for many residents of the Planning Area. Many individuals submitted comments suggesting that the BLM should prioritize actions that maintain open space, preserve unique landscapes, and protect scenic viewsheds. Several commenters mentioned specific areas and vistas, such as the McCullough Peaks area and the approach to the Big Horn Mountains through Ten Sleep that are most important to them. At least two commenters specifically stated concerns about nighttime visibility, which they feel is being degraded due to development in all forms (industrial, urban, and rural) contributing light pollution and air emissions. Some individuals recommended that the BLM minimize industrial development on public lands, such as oil and gas drilling, so as to preserve archeological and paleontological resources, open space, roadless areas, WSAs, and sagebrush steppe environment – even as some of these people also acknowledged the direct economic benefits of such industrial development. Several individuals commented that livestock grazing contributes to various values such as open space, wildlife habitat, buffers between federal lands and developed areas, and the traditional image and heritage of the historic rural landscapes of Wyoming and the Western United States. All of these comments can be considered as statements indicating non-market values that people hold.

In the context of the RMP and EIS, non-market values are implicitly included in the decision making context in the sense that market economic considerations, such as employment and tax revenues, are just one element affecting the development of the RMP alternatives, including the Agency Preferred Alternative. The RMP and EIS presents information about current conditions and potential impacts on a multitude of resources, including all of the resources that people value in a non-market context, such as open space, preservation and conservation of wildlife, and air quality. The present condition of these various resources, and the impacts on them from each of the alternatives, are evaluated within the RMP and EIS context, in concert with the analysis of market values as measured by employment, income, earnings, and tax revenues. Thus, although this RMP and EIS does not attempt to quantify the non-market values in dollar terms, the concepts that support non-market analysis – and the non-market values people hold – are built in to the RMP and EIS process and ultimately the development of the Proposed RMP.

3.8.2 Economic Conditions

Economic analysis is concerned with the production, distribution, and consumption of goods and services. This section provides a summary of economic information, including trends and current conditions. It also identifies and describes major economic sectors in the Planning Area that can be affected by BLM management actions.

Economic Activity and Output

This section provides detailed information about the industries that have the greatest potential to be directly affected by BLM policies and programs in the Planning Area. These industries include mining (including oil and gas); travel, tourism and recreation; and livestock grazing. The sections below on personal income, employment, and tax revenues provide information and data about jobs, earnings, and tax revenues contributed by these economic sectors, as well as other economic sectors, such as construction and manufacturing, that may be indirectly affected by BLM actions.

Economic Activity: Mining, Including Oil and Gas

Table 3-65 provides a summary of the quantity and value of mining production in the counties in the Planning Area, and for the state as a whole. Economically, the largest contributors to mining activity in all four counties are oil and gas; bentonite is also important in Big Horn County. Of the Planning Area counties, Park County has the greatest value of mineral production. Park County produces over 10 percent of the state's oil, while Big Horn County produces over half the bentonite in the state. Section 3.2 *Mineral Resources* contains additional information about mineral resources in the Planning Area.

Table 3-65. Mineral Production and Value by County in the Planning Area

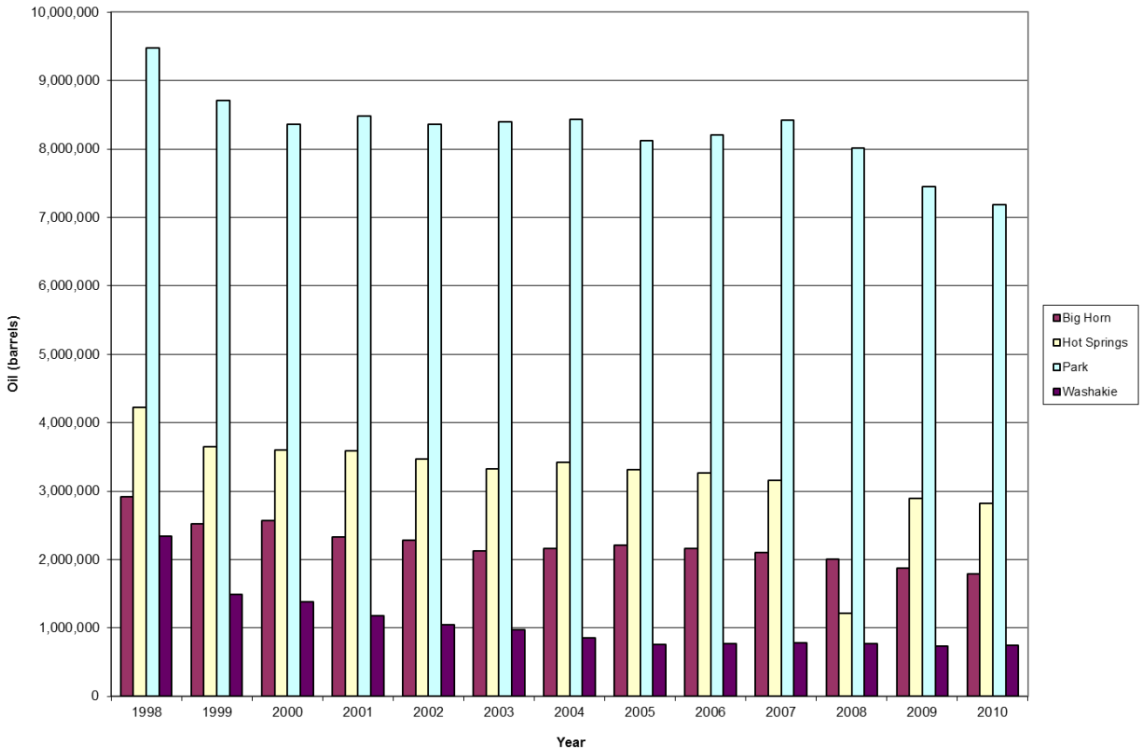
Mineral	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Production or Sales (units)					
Oil (barrels sold)	1,787,640	2,824,859	7,190,490	744,250	52,220,583
Gas (mcf sold)	2,126,856	128,975	9,616,074	1,991,028	2,429,249,686
Coal (tons)	0	25,913	0	0	438,751,440
Gypsum (tons)	283,755	0	42,126	0	325,881
Sand and Gravel (tons)	164,568	32,079	427,880	92,801	11,993,124
Bentonite (tons)	2,476,862	154,018	0	131,831	4,453,282
Taxable Valuation ($ millions)					
Oil	$114	$168	$440	$45	$3,273
Gas	$7	$1	$31	$7	$7,601
Coal	$0	$0.39	$0	$0	$4,020
Gypsum	$1	$0	$0.8	$0	$1.8
Sand and Gravel	$0.3	$0.05	$0.7	$0.1	$22.9
Bentonite	$35	$1.3	$0	$3.1	$64

Source: Wyoming DOR 2012. Data are for production year 2010.

mcf thousand cubic feet

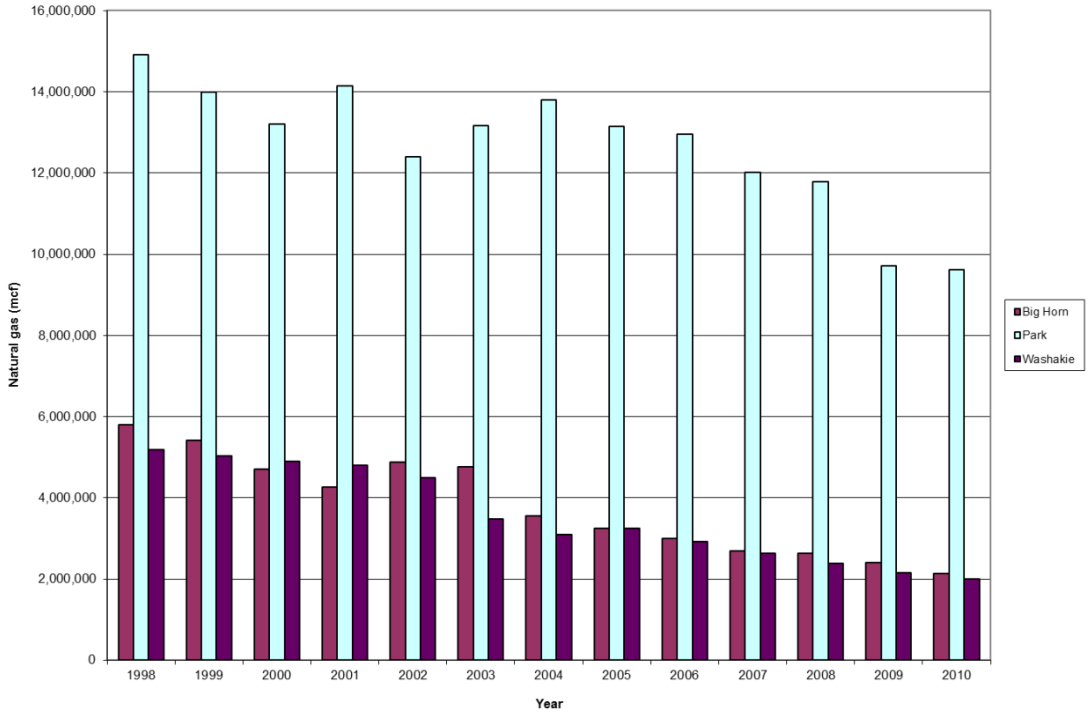
A trend analysis of production data suggests that oil and gas production generally decreased from 1998 to 2010, while bentonite production generally increased from 2002 to 2007 and dropped somewhat after 2007. Figures 3-21, 3-22, and 3-23 provide production trends for 1998-2010 for each of these.

Figure 3-21. Oil Production Trend, 1998-2010



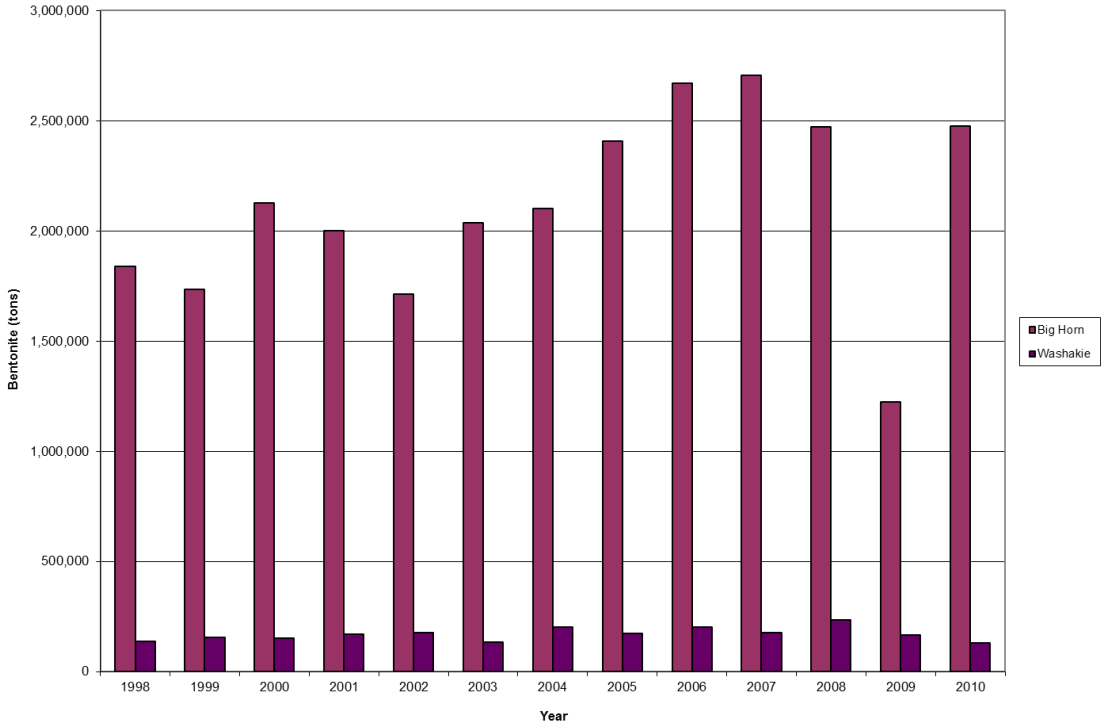
Sources: Wyoming DOR 1999; Wyoming DOR 2000; Wyoming DOR 2001; Wyoming DOR 2002; Wyoming DOR 2003; Wyoming DOR 2004; Wyoming DOR 2005; Wyoming DOR 2006; Wyoming DOR 2007; Wyoming DOR 2008; Wyoming DOR 2009; Wyoming DOR 2010; Wyoming DOR 2011; Wyoming DOR 2012.

Figure 3-22. Natural Gas Production Trend, 1998-2010



Sources: Wyoming DOR 1999; Wyoming DOR 2000; Wyoming DOR 2001; Wyoming DOR 2002; Wyoming DOR 2003; Wyoming DOR 2004; Wyoming DOR 2005; Wyoming DOR 2006; Wyoming DOR 2007; Wyoming DOR 2008; Wyoming DOR 2009; Wyoming DOR 2010; Wyoming DOR 2011; Wyoming DOR 2012. Note: Hot Springs County is not shown due to very low production.

Figure 3-23. Bentonite Production Trend, 1998-2010



Sources: Wyoming DOR 1999; Wyoming DOR 2000; Wyoming DOR 2001; Wyoming DOR 2002; Wyoming DOR 2003; Wyoming DOR 2004; Wyoming DOR 2005; Wyoming DOR 2006; Wyoming DOR 2007; Wyoming DOR 2008; Wyoming DOR 2009; Wyoming DOR 2010; Wyoming DOR 2011; Wyoming DOR 2012. Note: Only Big Horn and Washakie counties are shown; production is zero in Park County and very low in Hot Springs County.

Because the BLM manages subsurface mineral resources in excess of the surface lands it administers, its decisions can have a potentially large effect on mining in the Planning Area (see Section 3.2 *Mineral Resources* for more detail). From an economic perspective, mining is a key contributor to the economic well-being of the Planning Area, and therefore BLM's management decisions in this area could have a potentially large effect on economic conditions.

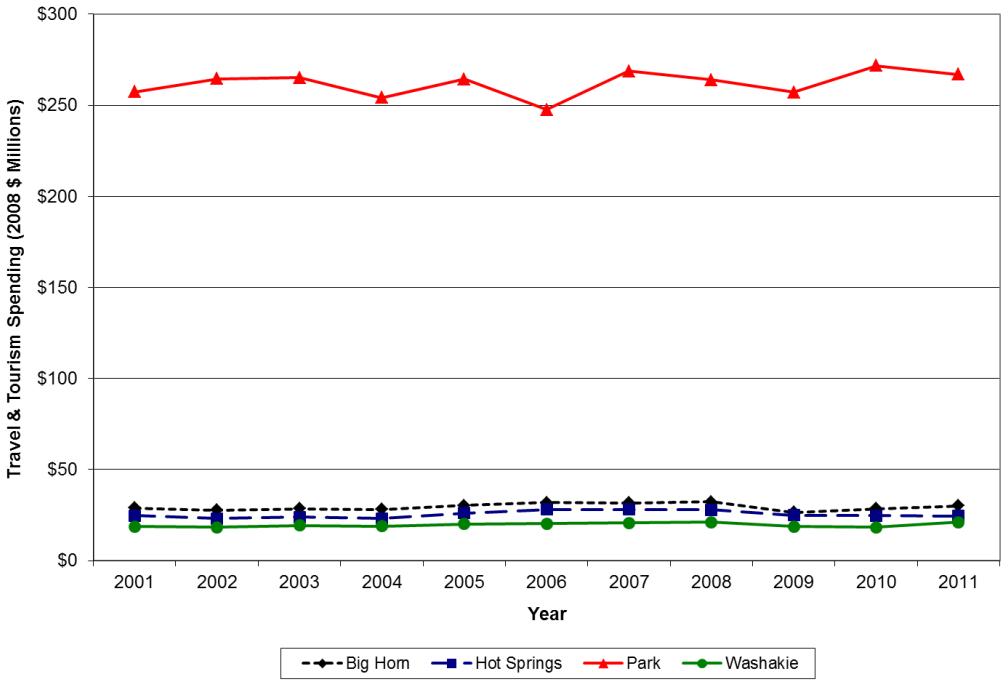
Economic Activity: Recreation

Federal lands within the Planning Area provide a broad spectrum of outdoor opportunities for Planning Area residents and visitors. Recreation on public lands also provides economic benefits. Recreation service providers (hotels, outfitters, equipment manufacturers and dealers, restaurants) depend on public lands, in part, for their livelihood.

Recreation visits are commonly measured in recreation visitor-days (RVDs). For several years, the WGFD estimated recreation patterns on BLM-administered land by field office, statewide. Based on the latest data available (2007), the WGFD estimated that the WFO received 123,600 RVDs for hunting and fishing on BLM-administered lands, and the CYFO received 60,034, for a total of 183,634 for the Planning Area. This represents about 18 percent of the hunting and fishing RVDs on BLM-administered land in Wyoming, and 5 percent of the hunting and fishing RVDs in Wyoming as a whole. Other popular recreation activities include camping and picnicking, driving for pleasure, nonmotorized travel, and motorized vehicle use (BLM 2009a). These recreational opportunities on BLM-administered lands contribute to economic values in the Planning Area in terms of both providing income from outsiders (visitors from outside the region who spend time and money in the region) and local residents.

Figure 3-24 shows travel and tourism spending in the Planning Area. In real terms, travel and tourism spending was essentially steady from 2001 to 2011 in all four counties in the Planning Area. Spending was much higher in Park County than the other three counties, presumably due to its proximity to Yellowstone National Park. The figure does not distinguish travel for business from travel for pleasure; however, a study by the Wyoming Office of Travel and Tourism indicates that statewide the great majority of trips (e.g., 98 percent, in 2006) are due to tourism for pleasure (Wyoming State Office of Travel and Tourism 2007). According to a report prepared by Dean Runyan Associates for Wyoming Travel and Tourism, travel and tourism related spending reached $364 million in the Planning Area in 2011 supporting over 4,400 jobs (Dean Runyan Associates 2012).

Figure 3-24. Travel and Tourism Spending in the Planning Area



Sources: Dean Runyan Associates 2007; Dean Runyan Associates 2008; Dean Runyan Associates 2010; Dean Runyan Associates 2012; adjusted for inflation using Wyoming Economic Analysis Division 2012a.

Economic Activity: Livestock Grazing

The BLM is responsible for administering livestock grazing on public lands across the Planning Area. Livestock grazing on public lands consists primarily of cattle, but also includes sheep, domestic horses, and small numbers of bison. In addition, goats and sheep are sometimes authorized for the purpose of suppressing weeds. The BLM administers 687 grazing allotments covering 3.2 million acres in the Planning Area. The majority of the allotments in the Planning Area operate under grazing strategies incorporating rest, seasonal rotations, deferment, and prescribed use levels that provide for adequate plant recovery time to enhance rangeland health (BLM 2009a).

According to data from the Rangeland Administration System, there are 78,324 active (use) AUMs in the Cody Field Office Planning Area and 226,522 active (use) AUMs in the Worland Field Office Planning Area, for a total of 305,264 active (use) AUMs. Whereas active (use) AUMs represent the maximum amount of forage generally available in any given year under a permit or lease, authorized AUMs

represent the total forage the BLM will allow the permittee to use in a given year. The BLM adjusts grazing use on an annual basis to account for the actual forage value of the land in a given year, based on climatic conditions (e.g., drought), as well as taking into account the needs of the land and the ranch operators. The number of AUMs actually used varies every year; from 1988 through 2012, the lowest number was 131,346 and the highest was 241,333. The average for these years was 194,672 AUMs, which is about 64 percent of the authorized AUMs (BLM 2010a, BLM 2014c).

BLM-administered grazing fees are calculated annually using a formula established by the Public Rangelands Improvement Act of 1978. These fees are lower on average than state or private lands because of the formula established by Congress. In addition, state and private land lease rates reflect the amount of control over the leased land exercised by the lessee, responsibility for maintenance of facilities, and services provided by the lessor. Federal grazing fees in Wyoming were $1.35 per AUM in 2013 and 2014 (BLM and USFS 2014). For comparison, grazing fees on state land were $5.13 in 2013 and 2014 (Wyoming SBLC 2014). The average grazing rate on privately owned nonirrigated land in Wyoming was $16.60 per AUM in 2010, $17.60 in 2011, and $18.70 in 2012 (NASS 2013).

Taylor et al. (2004) analyzed the importance of BLM-administered land for livestock grazing in nearby Fremont County using a simulated enterprise level ranch budget. They pointed out that most ranches are typically only partially dependent on federal land grazing for forage, but this forage source is a critical part of their livestock operation because of the seasonal dependency, even when the proportion of acres of AUMs contributed by federal land grazing is relatively small for the operation. Much of a ranch's private land is used as hay ground to produce hay for winter feeding. Using hay acreage to feed cattle during the summer means a ranch has to purchase hay for the winter. The rigidity of seasonal forage availability means that the optimal use of other forages and resources are impacted when federal AUMs are not available (Taylor et al. 2004). These authors, as well as many others in studies they reviewed from 1975 through 2002, found that potential reductions in income and net ranch returns are greater than the direct economic loss from reductions in federal grazing.

The USDA conducts a comprehensive national survey of agricultural operations every 5 years, the Census of Agriculture, which provides a rich source of data on agricultural operations down to the county level. The USDA maintains on an ongoing basis a list of agricultural operators who receive the Census of Agriculture survey in the mail, and follows up with various forms of outreach to ensure a high response rate. Data from the 2012 Census of Agriculture were released at the state level in February 2014, but the latest county-level information is still from 2007. The response rate for the 2007 survey was 85.2 percent. The USDA also adjusts the data to account for non-response, using well-established statistical methods (USDA 2009).

In 2007, there were 1,797 agricultural operations in the Planning Area counties according to the Census of Agriculture, which defines an agricultural operation (or "farm") as a place from which $1,000 worth of agricultural products is sold within a year (USDA 2009). Together, these farms and ranches encompassed about 2.3 million acres. The combined gross revenue of these operations, including agricultural products sold, government support payments, and other farm-related income, was $200 million. (This figure does not include income generated by employment or business activities which are separate from the farm business.) The net income aggregated across the 1,797 operations in the four Planning Area counties, according to the Census of Agriculture, was about $37.5 million.

Table 3-66 provides these data for individual counties in 2007, as well as data from the two most recent prior Census of Agriculture surveys (2002 and 1997). The table also provides state-level data for comparison. Table 3-66 shows a trend of increase in the number of farms with decrease of land in farms.

Table 3-66. Number of Farms, Land in Farms, Revenue, and Income, 1997-2007

Variable/Year	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Number of farms, 2007	621	180	782	214	11,069
Number of farms, 2002	501	147	711	184	9,422
Number of farms, 1997	495	147	588	205	9,232
Land in farms, 2007 (acres)	438,033	547,084	881,736	469,804	30,169,526
Land in farms, 2002 (acres)	411,782	876,560	810,302	426,500	34,402,726
Land in farms, 1997 (acres)	443,434	944,205	1,011,425	450,036	34,088,692
Total farm revenue, 2007	$57.2	$15.0	$85.9	$41.9	$1,245.8
Total farm revenue, 2002	$41.4	$8.9	$55.8	$26.8	$933.6
Total farm revenue, 1997	$45.0	$9.7	$67.9	$29.3	$932.6
Net farm income, 2007	$8.3	$4.5	$11.3	$13.3	$275.7
Net farm income, 2002	$4.4	$0.8	$9.0	$5.2	$115.3
Net farm income, 1997	$13.3	$2.1	$18.7	$8.6	$242.2

Sources: USDA 2009; USDA 2004; USDA 1999.

Note: Farm revenue and net farm income are in millions of current-year dollars (that is, not adjusted for inflation).

The U.S. Bureau of Economic Analysis (BEA) also provides data on farm income, which is presented below in Table 3-67. The most recent BEA data are from 2011, but 2007 data are also included in the table to facilitate comparison with the Census of Agriculture data. The 2007 data from BEA is somewhat different from that provided by the Census of Agriculture; for example, BEA's figures for gross income and net income are somewhat lower than those from the Census. For two of the four counties, this difference results in a negative value for net income reported by BEA, even as the Census reports a positive value for net income. However, the percentage breakouts for percent of income from livestock, crops, other farm-related sources, and government payments are very close to those from the USDA data.

Table 3-67. Farm Income in 2007 and 2011 from the U.S. Bureau of Economic Analysis

Data Item	Big Horn County	Hot Springs County	Park County	Washakie County
Farm Income in 2007 (2007 $ thousands)				
Gross Income	$53,944	$14,052	$78,848	$37,333
Percent of Income from Livestock	46%	77%	56%	58%
Percent of Income from Crops	38%	9%	35%	36%
Percent of Income from Other Sources[1]	12%	12%	7%	4%
Percent of Income from Government Payments	4%	2%	1%	2%
Net Income	-$6,465	$312	-$8,490	$3,199
Net Income Including Inventory Change	-$10,800	-$1,683	-$13,047	$442
Farm Income in 2011 (2011 $ thousands)				
Gross Income	$92,937	$17,456	$118,910	$55,773
Percent of Income from Livestock	32%	74%	43%	46%
Percent of Income from Crops	58%	14%	50%	49%
Percent of Income from Other Sources[1]	8%	11%	5%	3%
Percent of Income from Government Payments	2%	1%	1%	2%
Net Income	$16,771	$445	$9,234	$13,242
Net Income Including Inventory Change	$18,639	$1,803	$11,051	$15,561

Source: BEA 2012

[1]Includes the value of home consumption and other farm related income components, such as machine hire and custom work income and income from forest products. This category also includes royalty payments from oil and gas producers to farmers when oil/gas development occurs on farm lands (Kennedy 2008).

The difference between the BEA and Census (USDA) gross and net income estimates is attributable to different methods and data sources. USDA's Census data are based on the comprehensive survey of all farm operations that is conducted every 5 years, as described above. BEA annual farm income data (and also farm employment data) are based on county data from the 2002 and 2007 Censuses of Agriculture, annual county data from state offices that are affiliated with the NASS, and data from other sources within the USDA, such as the Farm Service Agency. The BEA generally uses the most detailed information available from the USDA Census of Agriculture; sometimes, this means beginning with data that is tabulated at the state level for a detailed range of commodities, and apportioning it to the county level using data for a less detailed range of commodities, because the county-level data is not available for the more detailed range. Where necessary, the 2003-2006 BEA data use interpolation between the 2002 and 2007 Census of Agriculture, and the data after 2007 are based partly on extrapolation (BEA 2010b).

Table 3-68 provides additional information from the 2007 Census of Agriculture on the estimated number of farm employees. The Census of Agriculture provides data on the number of farms with hired workers and, for those farms, the total workers hired and worker payroll. However, the Census does not attempt to calculate total farm employment. The table below shows a series of calculations to estimate farm employment; it makes the key assumption that farms without hired workers have one employee (that is, the farmer). Based on this method, total estimated farm employment in 2007 ranges from about 250 workers in Hot Springs County to 1,700 in Park County. This method produces employment

estimates that are greater than those provided in the annual BEA data release for 2007. As described in the paragraph immediately above, this is in part due to different methods and data sources. However, it may also be partly due to different definitions of employment: for instance, people employed for as little as 1 week during the year may be counted as employees for USDA purposes, whereas this arguably should not be considered a job per se. Finally, the assumption that every farm has at least one employee may be somewhat misleading. For instance, some people may argue that the proprietor of a very small operation, such as a market garden or home processing facility, with annual sales just over $1,000 should not be considered to have an employee.

Table 3-68. Estimated Number of Farm Employees, 2007

Variable	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Number of farms, 2007	621	180	782	214	11,069
Farms with hired labor	170	35	240	85	2,716
Farms without hired labor	451	145	542	129	8,353
Total workers hired, on farms with hired labor	621	106	1,158	315	9,826
Estimated total farm employment1	1,072	251	1,700	444	18,179
Worker payroll (for farms with hired labor)	$6.2	$1.2	$10.3	$3.8	$97.8

Source: USDA 2009, plus additional calculations to estimate total farm employment.

Note: Farm revenue and net farm income are in millions of current-year dollars (that is, not adjusted for inflation).

[1]Total farm employment is estimated based on the assumption that farms without hired labor have one employee (the farmer). See text for additional information.

Personal Income

This section describes personal income within the Planning Area. Table 3-69 provides a summary of the sources of personal income by place of work and county in the Planning Area. The table highlights county-level differences in the importance of various economic sectors, as well as the contribution of nonwage income, specifically dividends, interest, and rent, to personal income.

The BEA data that are used to create Table 3-69 do not readily distinguish recreation earnings because these earnings can occur in a variety of sectors, including retail trade, accommodation and food services, and hunting, fishing, and trapping (included in the same row as logging and agricultural services). Subsequent tables and text provide available information on expenditures and sales tax receipts from activities related to travel and tourism, which serve as the closest approximation for recreation.

Table 3-69. Personal Income and Earnings by Place of Work, 2011

Item/Sector	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming	United States
Population	11,759	4,799	28,592	8,487	568,158	311,591,917
Total personal income ($ millions)	$396	$209	$1,309	$355	$27,214	$12,949,905
Dividends, interest, and rent as a proportion of total personal income[1]	19%	21%	29%	23%	24%	16%
Dividends, interest, rent, and net transfer payments as proportion of total personal income[1]	33%	38%	39%	33%	30%	27%
Earnings by place of work ($ millions)[1]	$265	$124	$822	$241	$19,112	$9,454,199
Percent of total earnings by place of work (by sector)						
Farming	8%	2%	2%	6%	1%	1%
Fishing, logging, and related activities, including agricultural services[2]	N/A[3]	N/A[3]	0%	N/A[3]	0%	0%
Mining	17%	N/A[3]	10%	7%	16%	1%
Utilities	1%	N/A[3]	1%	2%	2%	1%
Construction	9%	4%	11%	9%	9%	5%
Manufacturing	5%	2%	3%	12%	4%	10%
Wholesale trade	3%	N/A[3]	2%	2%	3%	5%
Retail trade	N/A[3]	4%	8%	5%	6%	6%
Transportation and warehousing	5%	4%	2%	5%	5%	3%
Information	2%	1%	1%	2%	1%	3%
Finance and insurance	2%	2%	3%	4%	3%	8%
Real estate and rental and leasing	1%	1%	1%	2%	2%	2%
Professional and technical services	N/A[3]	N/A[3]	4%	3%	4%	10%
Management of companies and enterprises	N/A[3]	N/A[3]	1%	N/A[3]	1%	2%
Administrative and waste services	3%	N/A[3]	1%	N/A[3]	2%	4%
Educational services	0%	0%	0%	1%	0%	2%
Health care and social assistance	2%	10%	10%	11%	7%	11%
Arts, entertainment, and recreation	0%	2%	2%	1%	1%	1%
Accommodation and food services	1%	4%	6%	2%	4%	3%
Other services, except public administration	3%	3%	3%	3%	3%	4%
Government and government enterprises	30%	24%	26%	21%	24%	18%
Categories for which data were not disclosed	9%	37%	0%	4%	0%	0%

Source: BEA 2013

[1]Earnings by place of work differs from total personal income by the exclusion of dividends, interest, and rent, as well as adjustments to account for net transfer payments (e.g., unemployment benefits and Social Security taxes and payments) and the residential adjustment.
[2]"Related activities" includes hunting and trapping, as well as agricultural services such as custom tillage.
[3]Data were not disclosed due to confidentiality reasons (Bureau of Economic Analysis does not report data when there are three or fewer employers in a sector). The line item "Categories for which data were not disclosed" shows the total income attributable to these categories for each county.

N/A Not available

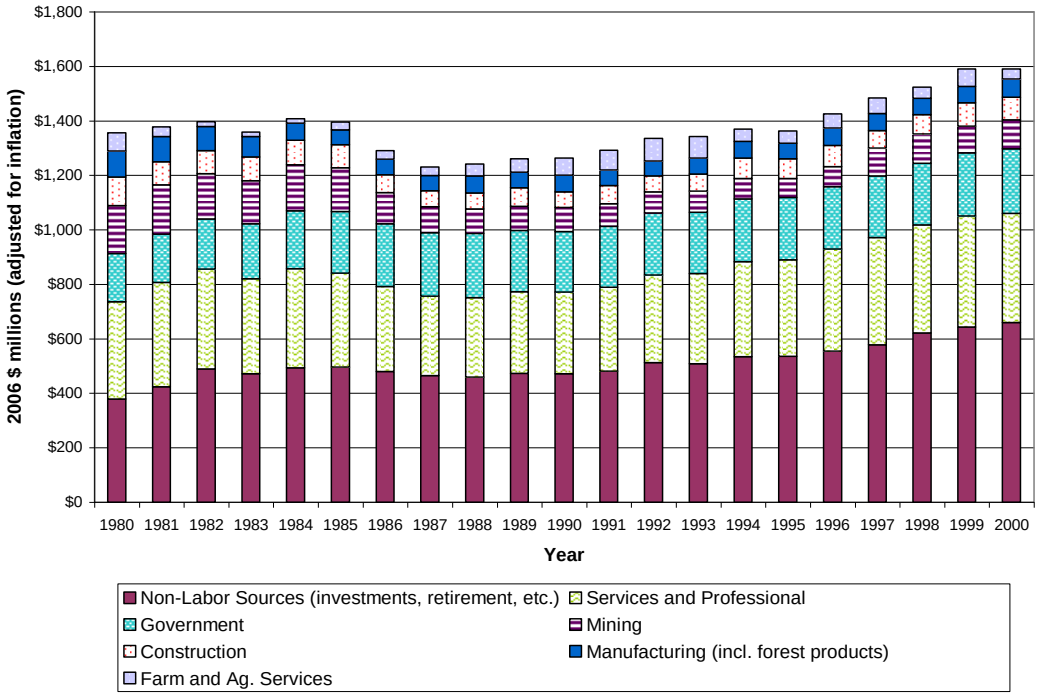
Figure 3-25 shows historic trend information on sources of income for the four Planning Area counties, aggregated. (Historic trend information for individual counties is available in the profiles from Headwaters Economics [Headwaters Economics 2007a, Headwaters Economics 2007b; Headwaters Economics 2007c; Headwaters Economics 2007d], which are on the RMP website.) The figure shows trends for 1980 through 2000. Because of a change in the industrial classification system in year 2000, it is not possible to construct a single continuous data set that would provide sector-level data both before and after year 2000.

Figures 3-26 through 3-29 show trend information on sources of income for the Planning Area counties from 2001 through 2011. The counties are not aggregated together for this trend data because of the issue of non-disclosure of data. Federal non-disclosure policies prohibit the BEA from releasing earnings data for counties where there are three or fewer employers in a given sector. If there is only one sector in this situation, BEA must also hide data for another sector so as to avoid effective disclosure of the data of concern (since BEA provides sum-of-sectors data as well as individual sectors). The problem of non-disclosure for individual sectors is compounded when attempting to assemble a series across different years and different counties. For instance, while BEA disclosed data for sixteen of the 21 main sectors for Big Horn County in 2001, it disclosed data for only twelve of the 21 sectors for Big Horn County continuously from 2001-2011. With similar disclosure policies applied to the other counties, there are only five sectors for which BEA disclosed data continuously from 2001-2008 for all four counties. Thus, the figures shown here are for each individual county and show the magnitude of the sectors for which BEA did not disclose data in each year.

(Note that the Headwaters Institute has developed a special algorithm to estimate earnings for these "non-disclosed" sectors for the data series between 1980 and 2000, but has not developed an algorithm to estimate earnings for the data series after 2000).

Figure 3-25 shows that the change in income from 1980 to 2000 (adjusted for inflation) is largely driven by changes in non-labor income, such as investment income and Social Security payments. The magnitude of income from other sources, adjusted for inflation, remained relatively constant within each sector from 1980 to 2000.

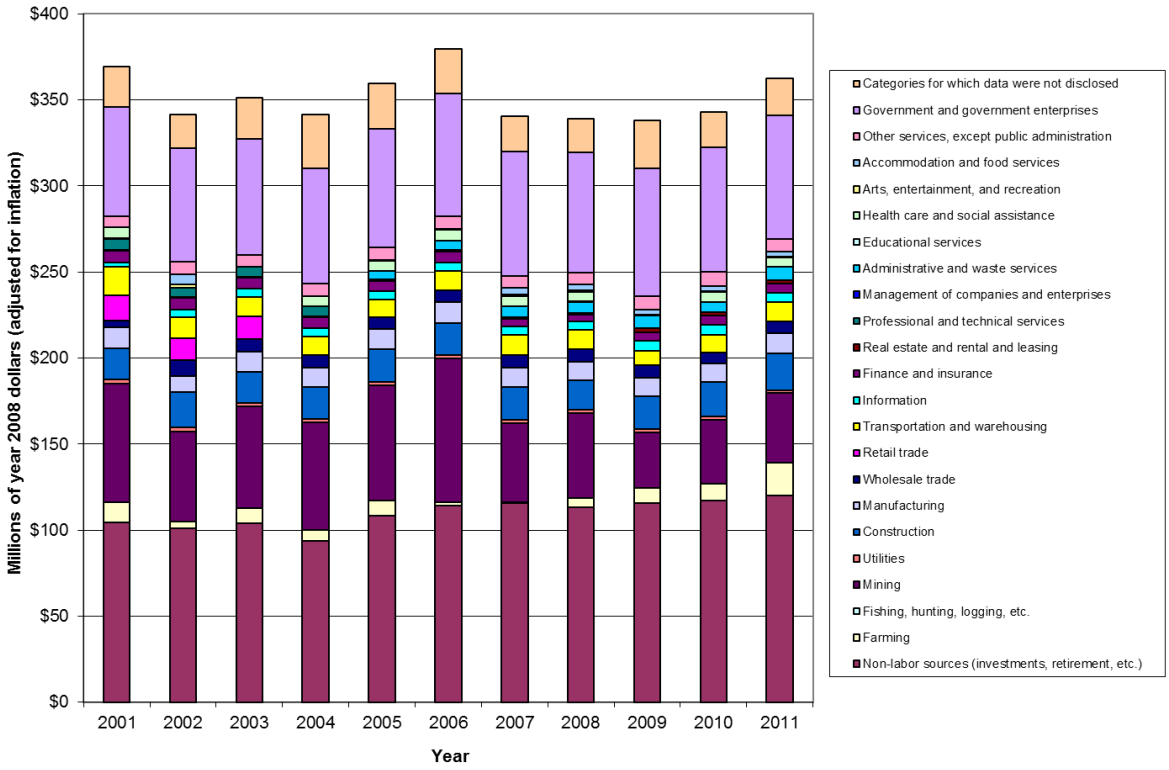
Figure 3-25. Income by Sector within Planning Area Counties, 1980-2000



Source: BEA 2010a

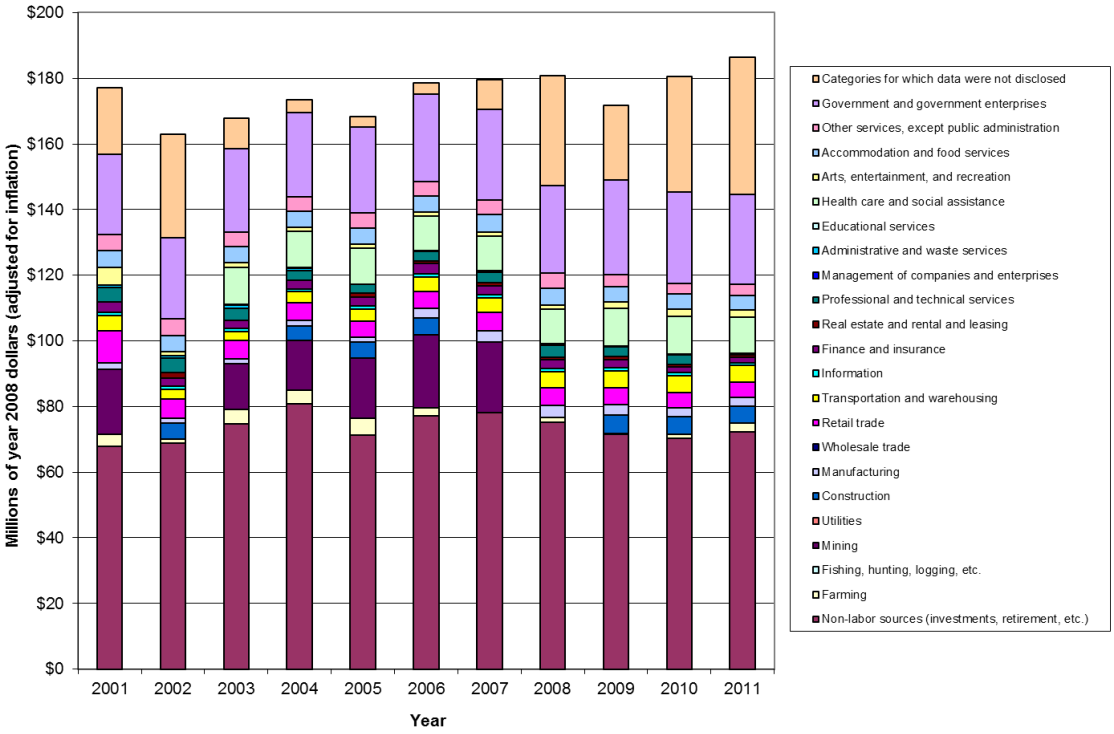
Ag. Agricultural
incl. including

Figure 3-26. Income by Sector within Big Horn County, 2001-2011



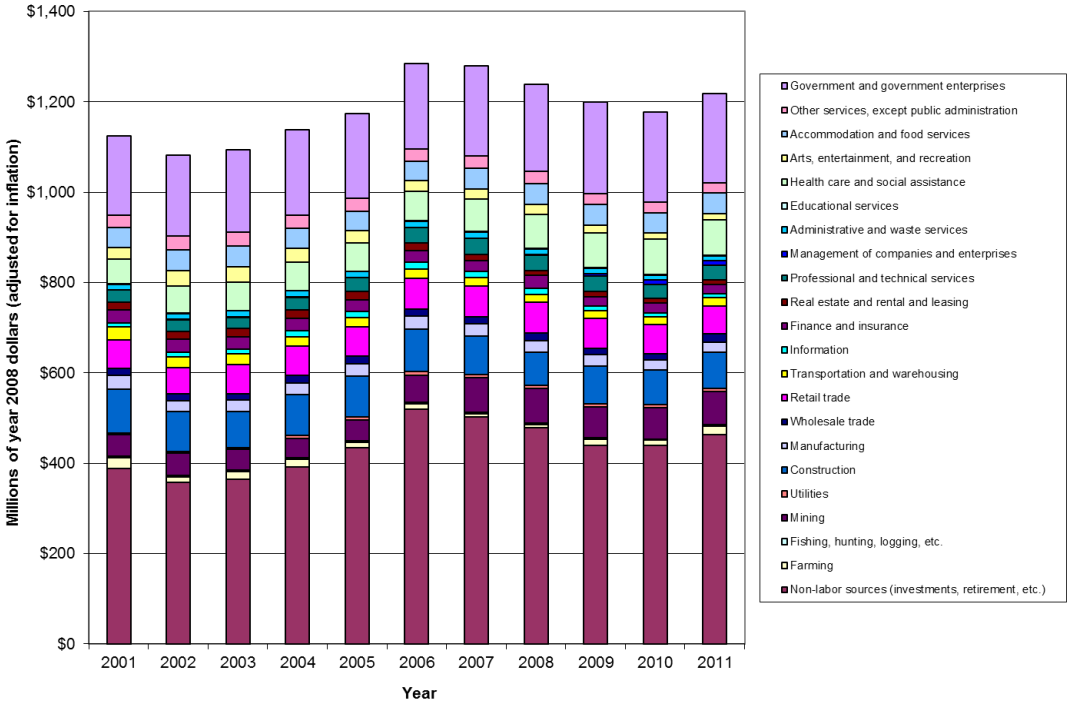
Sources: BEA 2010a; BEA 2012; adjusted for inflation using Wyoming Economic Analysis Division 2012a.

Figure 3-27. Income by Sector within Hot Springs County, 2001-2011



Sources: BEA 2010a; BEA 2012; adjusted for inflation using Wyoming Economic Analysis Division 2012a.

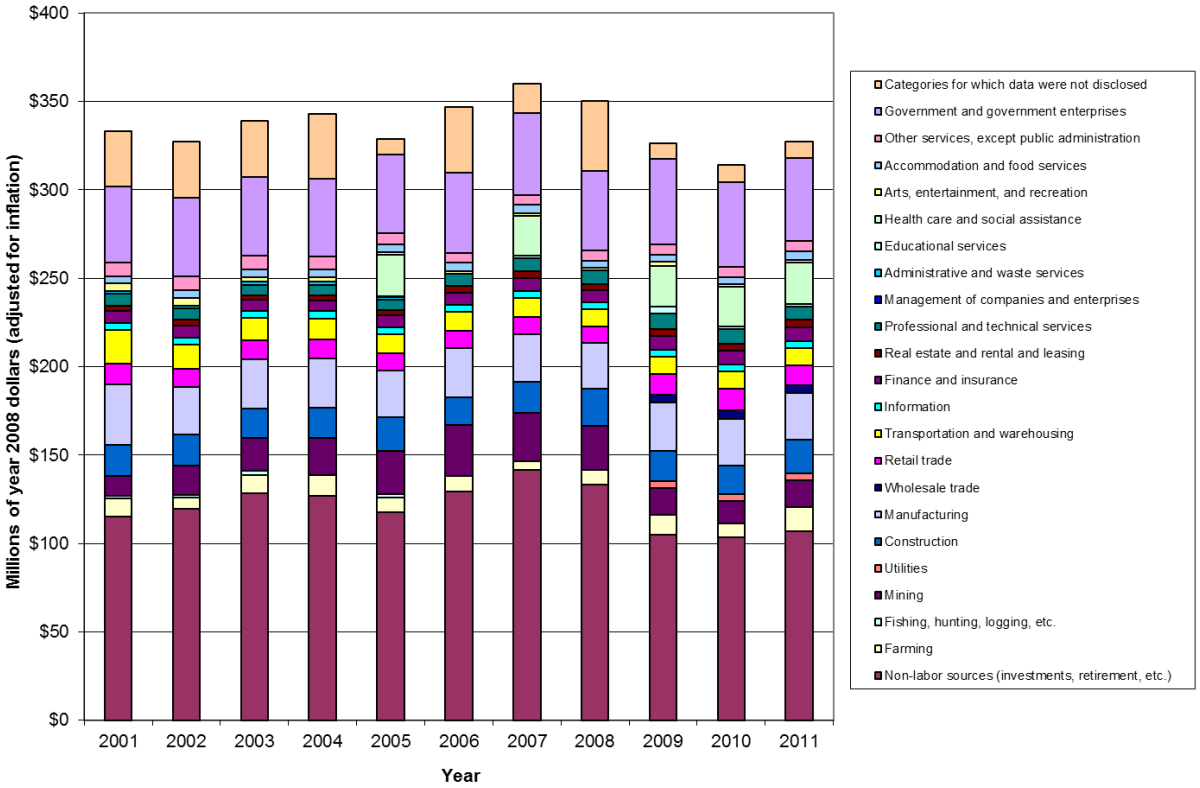
Figure 3-28. Income by Sector within Park County, 2001-2011



Sources: BEA 2010a; BEA 2012; adjusted for inflation using Wyoming Economic Analysis Division 2012a.

Note: Data were disclosed for all sectors in Park County continuously from 2001 to 2011.

Figure 3-29. Income by Sector within Washakie County, 2001-2011



Sources: BEA 2010a; BEA 2012; adjusted for inflation using Wyoming Economic Analysis Division 2012a.

Although there are particular circumstances in each county, there are some common threads in the four figures above showing income data from 2001 through 2011. Non-labor income sources represent a substantial share of income in all four counties. The variation in non-labor income over time is generally the biggest influence on total income. Mining is also a sector for which there is both a substantial amount of variation over time, and the mining sector contributes to changes in total income in all four counties. Other sectors, most notably construction, retail trade, health care and social assistance, accommodation and food services, and government, contribute a noticeable share in all or virtually all years, but these tend to be fairly steady over time. Note that the effects of non-disclosure are readily visible in the charts above: for instance, mining earnings were not disclosed in Hot Springs County in 2002 or 2008. These and other variations in disclosure are evident when a sector has widely divergent earnings in different years in the same county.

Table 3-70 provides a summary of mining-related earnings and employment for the Planning Area counties for detailed sub-industry sectors, for the latest year these data are available (2011). The table shows that oil and gas mining and support activities related to oil and gas contribute the majority of mining employment and payroll in Hot Springs, Park, and Washakie counties. In Big Horn County, a sizable amount of mining-related employment is also attributable to the mining of non-metallic minerals (e.g., bentonite). The data in Table 3-70 reflect workers by their place of employment, which means that employees within "general contracting" industries – such as construction workers or environmental contractors who sometimes work for mining companies, but also have other clients – are not included in the category of support activities. Thus, the regional contribution of the mining industry is somewhat more than is shown in the table.

Table 3-70. Earnings and Employment for Mining Activities (2011)

Source	Big Horn County		Hot Springs County		Park County		Washakie County	
	Employees	Payroll ($000)[1]	Employees	Payroll ($000)[1]	Employees	Payroll ($000)[1]	Employees	Payroll ($000)[1]
Mining	418	22,712	228	15,072	250-499	N/A[2]	100-249	6,617
Oil and Gas Extraction	0-19	N/A[2]	20-99	N/A[2]	100-249	N/A[2]	20-99	N/A[2]
Mining (Except Oil and Gas)	250-499	N/A[2]	0	0	0-19	N/A[2]	0-19	N/A[2]
Coal Mining	0-19	N/A[2]	0	0	0	0	0	0
Metal Ore Mining	0	0	0	0	0-19	N/A[2]	0	0
Nonmetallic Mineral Mining and Quarrying	250-499	N/A[2]	0	0	0	0	0-19	N/A[2]
Mining Support Activities	100-249	N/A[2]	187	12,002	252	15,200	20-99	N/A[2]
Drilling Oil and Gas Wells	0-19	N/A[2]	100-249	9,374	100-249	N/A[2]	22	963
Oil and Gas Operations Support Activities	100-249	N/A[2]	20-99	N/A[2]	20-99	N/A[2]	20-99	N/A[2]
Support Activities for Coal Mining	0	0	0	0	0	0	0	0
Support Activities for Metal Mining	0	0	0	0	0	0	0	0
Nonmetallic Minerals Support Activity (Except Fuels)	0	0	0	0	0	0	0-19	N/A[2]

Source: U.S. Census Bureau 2011b. Number of employees is for week ending March 12, 2011. Payroll data (in thousands of dollars) are for the entire year.

[1]For most sectors, the data source reveals a range rather than an exact number of employees so as not to disclose confidential business information (because there are relatively few employers in the sector).
[2]The data source does not reveal data on payrolls for this sector due to confidentiality requirements.

$000 $ thousands
N/A not available

Employment

Table 3-71 provides a summary of employment by sector for the counties in the Planning Area. The breakout is comparable to the earnings table above; in most of the counties, substantial portions of employment are derived from mining, construction, retail trade, and government. However, the differences between the two tables highlight the divergence in earnings per job in different sectors. For example, whereas mining contributes 17 percent of earnings in Big Horn County, it contributes proportionally fewer jobs (10 percent), which illustrates the relatively high wages per job in the mining sector. Similarly, retail trade accounts for 11 percent of jobs in Park County and 8 percent of jobs in each of Hot Springs and Washakie counties, but contributes just 8 percent of earnings in Park County, and 4 to 5 percent in Hot Springs and Washakie. This divergence indicates that wages per job in this sector are relatively low, either because of lower wages per hour or because some jobs in the sector are seasonal or part-time. For information on seasonal variations in employment, see the discussion of Transient and Seasonal Populations in Section 3.8.1 *Social Conditions*.

Note that the data in the table below are from BEA. As noted above under the "Economic Activity: Livestock Grazing" header in this section, BEA's data on agricultural operations differ from USDA Census of Agriculture data. As relates to employment, the number of farm employees reported by BEA is generally lower than that reported in the Census of Agriculture. According to the estimates in Table 3-68, Big Horn County had 1,072 farm employees, Hot Springs had 251, Park had 1,700, and Washakie had 444, in 2007. As noted, the 2012 Census of Agriculture is still being conducted and the latest data available are for 2007.

Table 3-71. Employment by Sector, 2011

Sector	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming	United States
Farm employment	11%	6%	5%	5%	3%	1%
Fishing, hunting, logging, and related activities, including agricultural services[1]	N/A	N/A	1%	N/A	0.7%	0.5%
Mining	10%	N/A	5%	4%	9%	0.8%
Utilities	0.3%	N/A	0.4%	0.8%	0.7%	0.3%
Construction	7%	4%	8%	7%	7%	5%
Manufacturing	4%	3%	3%	8%	3%	7%
Wholesale trade	2%	N/A	2%	2%	3%	3%
Retail trade	N/A	8%	11%	8%	10%	10%
Transportation and warehousing	3%	4%	2%	4%	4%	3%
Information	2%	2%	1%	2%	1%	2%
Finance and insurance	3%	4%	4%	4%	4%	5%
Real estate and rental and leasing	3%	4%	5%	5%	5%	4%
Professional and technical services	N/A	N/A	4%	4%	4%	7%
Management of companies and enterprises	N/A	N/A	0.6%	N/A	0.3%	1%
Administrative and waste services	6%	N/A	3%	N/A	3%	6%

Table 3-71. Employment by Sector, 2011 (Continued)

Sector	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming	United States
Educational services	0.5%	1%	1%	0.8%	0.9%	2%
Health care and social assistance	4%	11%	8%	11%	7%	11%
Arts, entertainment, and recreation	1%	3%	3%	1%	2%	2%
Accommodation and food services	4%	9%	11%	6%	8%	7%
Other services, except public administration	4%	6%	5%	5%	5%	6%
Government and government enterprises	23%	18%	18%	16%	19%	4%
Categories for which data were not disclosed	12%	19%	0%	5%	0%	0%
Total employment (number of jobs)	**7,020**	**3,399**	**20,915**	**5,732**	**391,484**	**75,834,700**

Source: BEA 2012

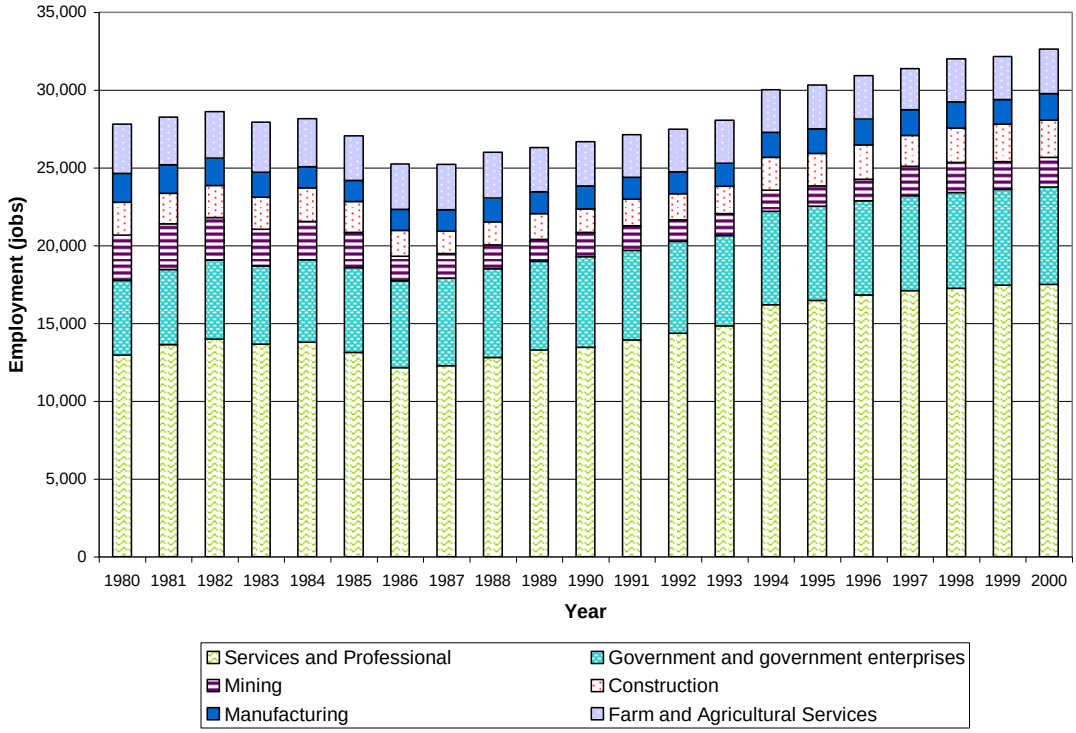
[1]Related activities includes hunting and trapping, as well as agricultural services such as custom tillage.

N/A not available

Figure 3-30 shows historical employment trends for the four Planning Area counties, aggregated. (Trend information for individual counties is available in the profiles from Headwaters Economics (Headwaters Economics 2007a; Headwaters Economics 2007b; Headwaters Economics 2007c; Headwaters Economics 2007d), which are on the RMP website.) The figure shows trends for 1980 through 2000. As noted above, due to a change in the industrial classification system in year 2000, and federal non-disclosure policies, it is not possible to construct a table or graph with meaningful trend information after year 2000. The data in the figure indicate that the number of jobs in the services and professional sectors accounted for the majority of changes in employment from 1980 to 2000. Mining jobs were higher in the early 1980s and mid to late 1990s, while government sector jobs grew somewhat starting in the mid to late 1980s. The number of jobs in other sectors remained relatively stable from 1980 to 2000.

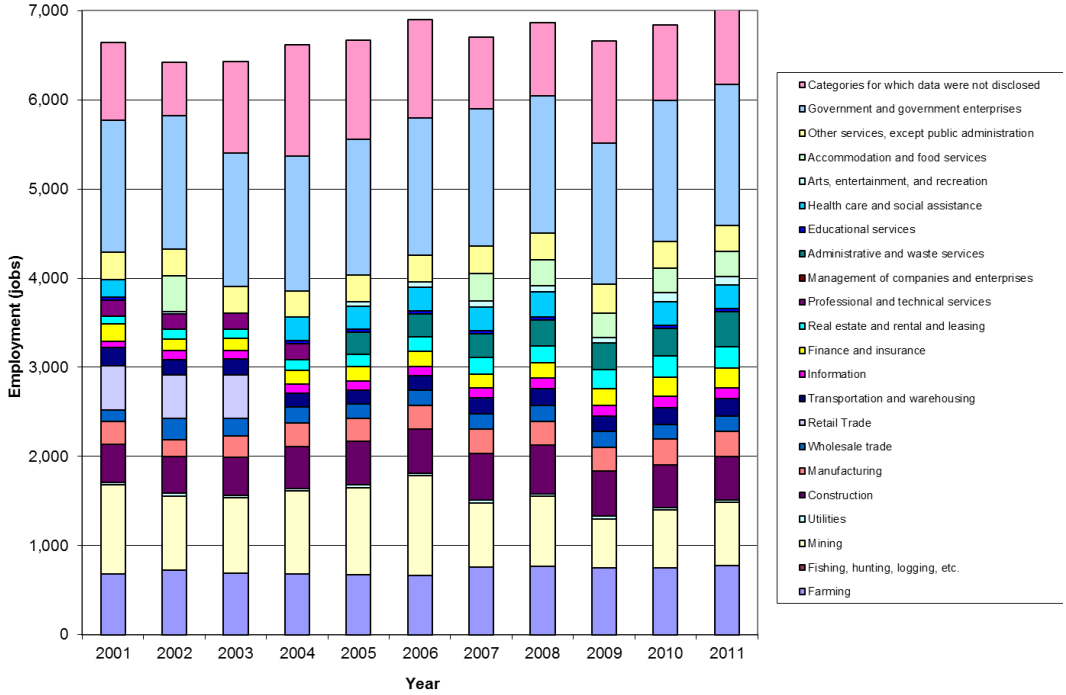
Figures 3-31 through 3-34 show trend information on sources of employment from 2001 through 2011. Similar to the income figures above, and for the same reasons, the counties are not aggregated for this trend data because of the issue of non-disclosure of data. The figures shown here are for each individual county, and show the magnitude of the sectors for which BEA did not disclose data in each year.

Figure 3-30. Employment by Sector within Planning Area Counties, 1980-2000



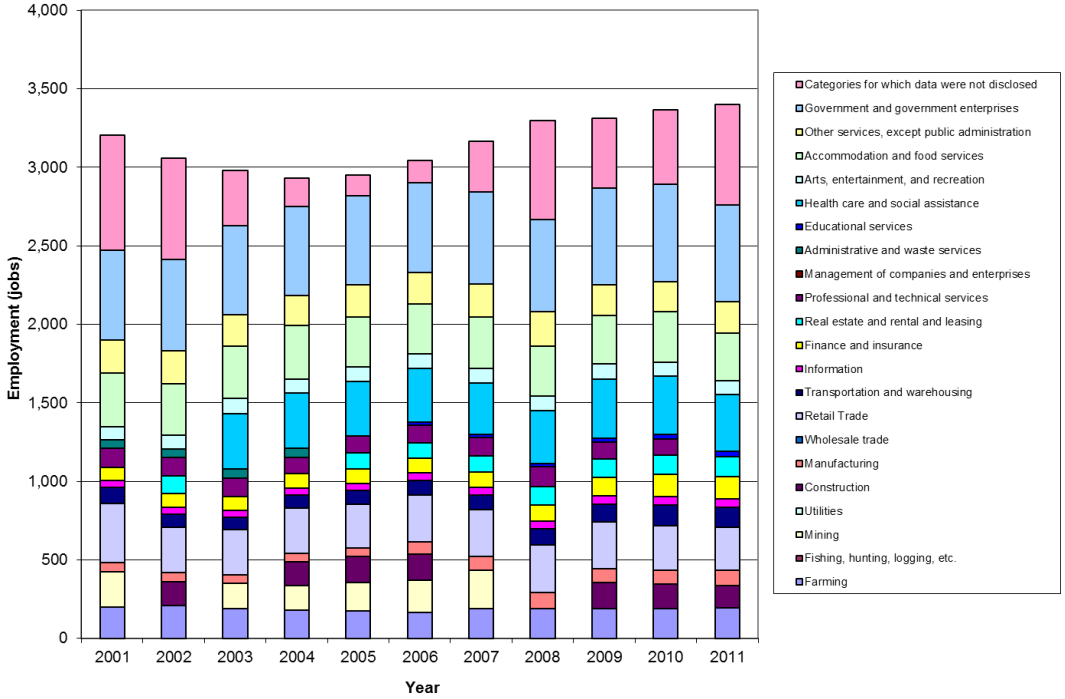
Source: BEA 2010a

Figure 3-31. Employment by Sector within Big Horn County, 2001-2011



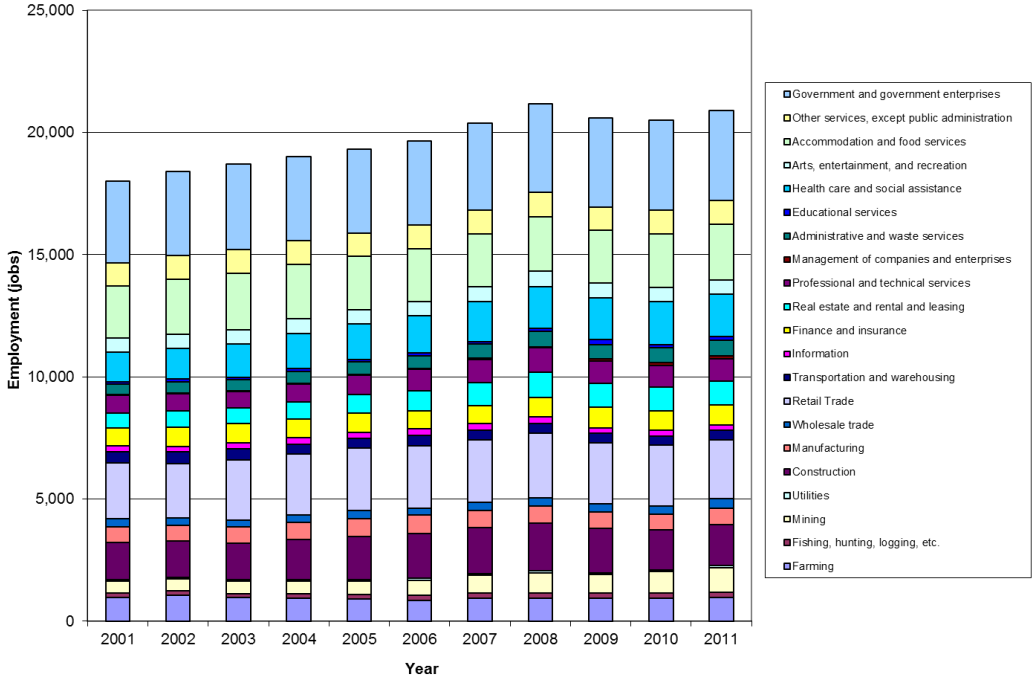
Sources: BEA 2010a; BEA 2012.

Figure 3-32. Employment by Sector within Hot Springs County, 2001-2011



Sources: BEA 2010a; BEA 2012.

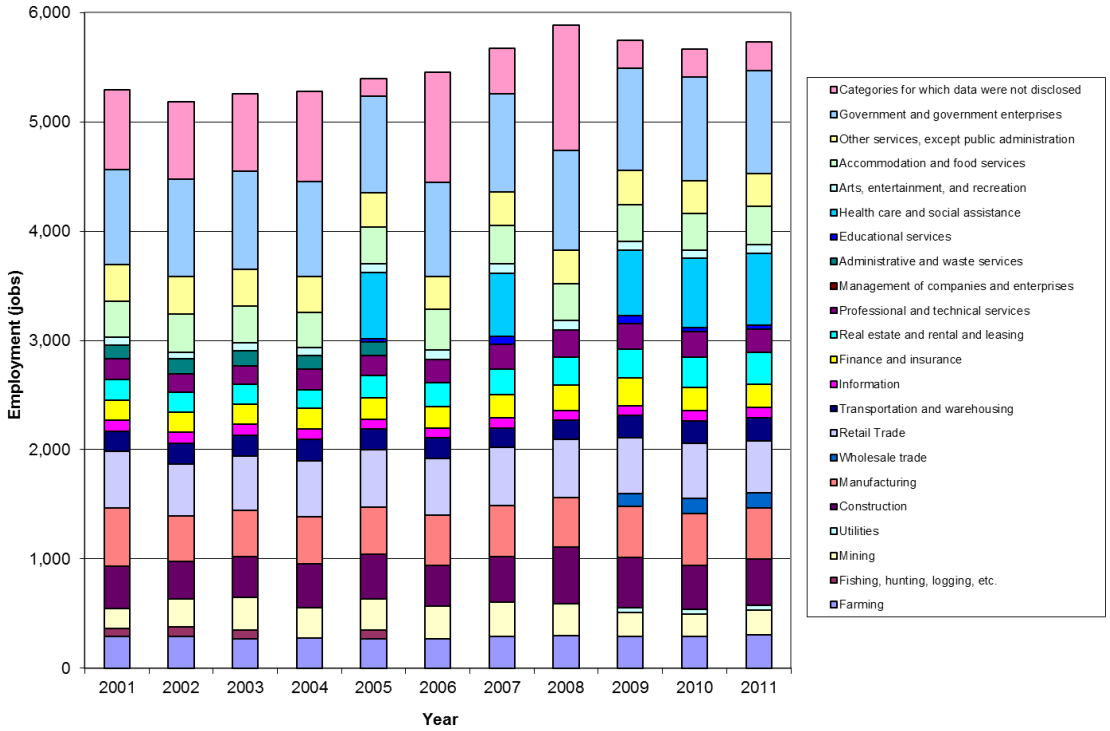
Figure 3-33. Employment by Sector within Park County, 2001-2011



Sources: BEA 2010a; BEA 2012.

Note: Data were disclosed for all sectors in Park County continuously from 2001 to 2011.

Figure 3-34. Employment by Sector within Washakie County, 2001-2011



Sources: BEA 2010a; BEA 2012.

Like the income figures, there are particular circumstances in each county but there are some common threads in the 2001-2011 employment trends. In general, certain sectors provide a steady source of employment with little variation over time: farming, accommodation and food services, retail trade, construction, manufacturing, and government. In Park County, the increase in employment over time is attributable to slight increases in construction, retail trade, and health care and social assistance. Park, Washakie, and Hot Springs counties all saw small, steady increases in employment for 2002-2008, but there is no obvious driver (partly because the intermittent nondisclosure makes it difficult to determine trends over time, but partly because there were no large jumps in employment for any sector during that period). In 2009, employment declined slightly a result of the housing market decline and the nationwide recession, but has returned to a trajectory of growth since then. Note that, like the income figures, the effects of non-disclosure are readily visible when a sector has widely divergent employment numbers in different years within the same county.

Table 3-72 shows three different measures of earnings and income for the Planning Area counties, using the most recent available data. On all three earning and income measurements, income and earnings in the Planning Area counties are lower than for the state as a whole. In addition, median household income and average earnings per job are lower in the Planning Area counties than in the United States. Per capita income is lower than the national average in Big Horn County, but greater than the national average in the other three counties. The relative difference between average earnings per job (which measures employment income only) and per capita income (which also includes dividends, interest, rent, and transfer payments such as Social Security) in Hot Springs, Park, and Washakie counties underscores the importance of nonwage income in these counties, which is also identified above in the earnings data.

Table 3-72. Average and Median Income; Average Earnings per Job

Area	Per Capita Income (2011)	Average Earnings Per Job (2011)	Median Household Income (2011)
Big Horn County	$33,682	$37,683	$49,929
Hot Springs County	$43,615	$36,580	$41,845
Park County	$45,799	$39,292	$50,141
Washakie County	$41,837	$41.972	$49,747
State of Wyoming	$47,898	$48,820	$56,044
United States	$41,560	$53,768	$50,502

Sources: BEA 2010a (per capita income and average earnings per job); BEA 2012 (median household income).

Table 3-73 shows the unemployment rate for counties in the Planning Area compared to state and national levels. As the table shows, unemployment in the Planning Area counties from 2006 through April 2012 has been lower than in the United States, though greater than the statewide rate in 2006-2008. While the national unemployment rate ticked up in 2008, unemployment remained steady in the Planning Area counties. Between 2008 and 2009, unemployment in the Planning Area counties increased, as in the State of Wyoming and in the country as a whole, declining slightly after 2010.

Table 3-73. Unemployment Rate in 2006-2012

Area	2006	2007	2008	2009	2010	2011	2012
Big Horn County	4.3%	4.2%	4.2%	8.7%	8.0%	7.1%	6.2%
Hot Springs County	3.7%	3.4%	3.4%	6.0%	5.6%	5.2%	4.7%
Park County	3.7%	3.2%	3.7%	6.2%	6.9%	6.3%	5.8%
Washakie County	3.7%	3.6%	3.7%	6.2%	6.6%	6.0%	5.4%
State of Wyoming	3.2%	2.9%	3.2%	6.4%	7.0%	6.1%	5.4%
United States	4.6%	4.6%	5.8%	9.3%	9.6%	8.9%	8.1%

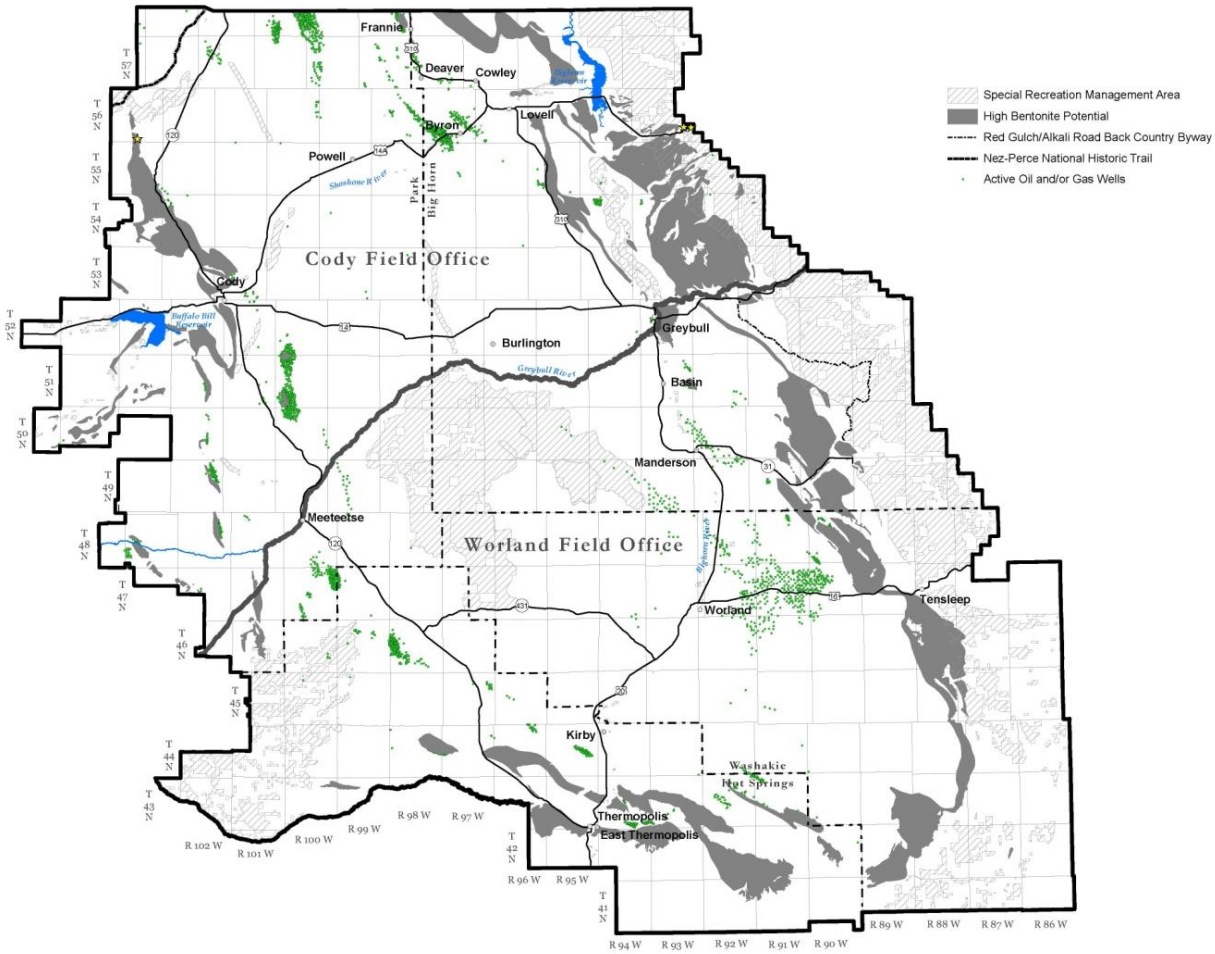
Sources: BLS 2010a; BLS 2010b; BLM 2013a.

Note: figures presented are annual averages.

Spatial Distribution of Employment

Some features of the economic landscape are common to the communities within the Planning Area, while in other ways the communities vary in their employment base. In all the communities, BLM land influences employment (directly, indirectly, or both) as well as other quality of life factors. To elucidate the geo-spatial employment patterns, Figure 3-35 shows the geographic dispersion of certain critical BLM uses, including SRMAs, areas of high bentonite potential, and active oil and gas wells. The Planning Area is authorized for livestock grazing, except for the areas shown on Map 81.

Figure 3-35. Geographic Dispersion of Selected Features



Source: BLM 2013a

Oil and gas deposits occur throughout the basin. Nearly every community lies within twenty miles from at least one cluster of active oil and gas wells; Powell and Burlington are the only exceptions. The largest clusters of oil and gas wells are proximate to Worland, Cody, and the towns in the northwest corner of Big Horn County (Byron, Lovell, Cowley, Deaver, and Frannie). Livestock grazing, as it is coterminous with BLM-administered surface, also occurs throughout the Planning Area, and all the communities are located very close to some area used for grazing. SRMAs, representing key recreational areas administered by the BLM, are concentrated in the center of the basin (near Burlington, Meeteetse, Manderson, and Kirby) and on the eastern edge (the Big Horn Mountains, near Lovell, Greybull, Worland, and Ten Sleep). Areas of high bentonite potential occur on the edges of the basin, particularly in Big Horn and Washakie counties (which together account for a large portion of the state's bentonite production).

To supplement the figure, Table 3-74 shows the distribution of employment for the larger communities in the Planning Area. Unfortunately, the only data source that provides information about sector-level employment at the resolution of individual communities is the 2000 Census, which means these data are relatively old. In addition, the Census tabulation for this data item is based on a 1-in-6 sample,

which means that data tabulated for very small communities has a substantial amount of error. For instance, a community with 300 residents would have about 50 people responding to the survey; if only 35 of those people are of working age, and they work in fifteen different employment sectors, then an aberration in the sample (e.g., three people who work in the construction industry, and none who work in mining) can suggest a population-level effect that does not actually hold true. For this reason, Table 3-74 shows only data for towns with greater than 600 employed people in the year 2000.

As expected, the data show some similarities in employment patterns. The service sectors, especially education, health care, and social assistance, and the retail trade sector contribute a sizable proportion of employment in all of the communities shown. Among sectors that are influenced directly by BLM actions, mining is most important in Greybull and Lovell; agriculture provides a small but important contribution to employment in all of the communities (with Worland and Powell having the largest shares), and recreation, accommodation, and food services, which is combined with arts and entertainment in the Census tabulation, provides a sizable share of employment in all of the communities (12 to 16 percent in all of the communities shown except Lovell).

Table 3-74. Employment by Sector, 2000

Sector	Cody	Greybull	Lovell	Powell	Thermo-polis	Worland
Agriculture, forestry, fishing and hunting	3%	2%	4%	5%	2%	5%
Mining	3%	9%	10%	3%	3%	8%
Construction	8%	8%	10%	4%	8%	6%
Manufacturing	7%	2%	9%	4%	3%	9%
Wholesale trade	1%	2%	1%	4%	1%	3%
Retail trade	15%	15%	11%	11%	7%	12%
Transportation and warehousing, and utilities	4%	9%	3%	5%	6%	4%
Information	2%	3%	1%	3%	3%	2%
Finance, insurance, real estate and rental and leasing	6%	6%	4%	6%	5%	4%
Professional, scientific, management, administrative, and waste management services	8%	3%	2%	6%	2%	5%
Educational services	7%	10%	12%	15%	13%	6%
Health care and social assistance	13%	8%	17%	15%	22%	13%
Arts, entertainment, recreation, accommodation and food services	13%	14%	7%	12%	16%	12%
Other services (except public administration)	6%	4%	6%	4%	6%	6%
Public administration	4%	5%	4%	2%	4%	5%
Total employment (number of jobs)	**4,266**	**808**	**959**	**2,413**	**1,525**	**2,422**

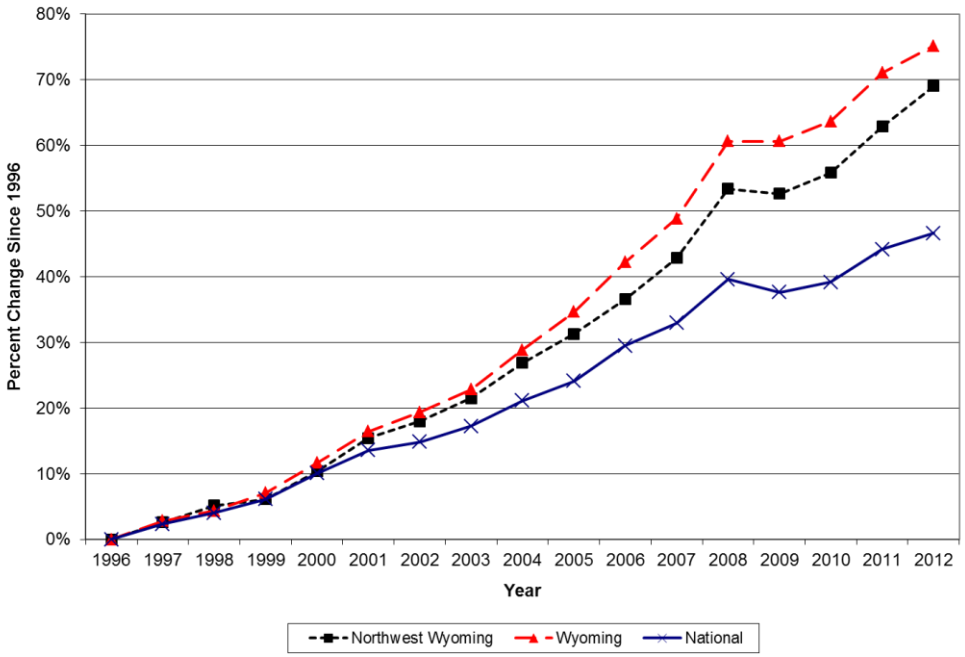
Source: U.S. Census Bureau 2000

Cost of Living

One factor that affects economic and social trends within the communities is the cost of living. The Wyoming Economic Analysis Division calculates relative changes in cost of living over time by estimating the cost of a set of goods and services that represents the average consumer's purchases for housing, food, health care, travel costs, and other items. If the cost of living for a particular area increases faster than average income, that may mean that long-time residents, especially those on fixed incomes, may find their lifestyle less affordable over time. Over a long period of time, a higher cost of living may encourage people to relocate from a community and discourage migration into a community by households not seeking to relocate in conjunction with employment opportunities. Overall migration into the area will likely decrease, and the demographic and socioeconomic characteristics of those who move in will be determined partially by the cost of living in the area.

The Wyoming Economic Analysis Division (Wyoming Economic Analysis Division 2012a) calculates the change in the cost of living over time for a five-county region in northwest Wyoming, consisting of Big Horn, Hot Springs, Park, Teton, and Washakie counties. Figure 3-36 shows how the cost of living in northwest Wyoming has changed relative to the cost of living in Wyoming generally and in the United States. Starting around 2000, the cost of living in the northwest region and Wyoming as a whole began to increase at a greater rate than the nation. The cost of living in the northwest region has risen slightly more slowly than for the state as a whole. By 2008, compared to 1996, the cost of living in northwest Wyoming had risen by about 55 percent, compared to 60 percent statewide and 40 percent for the United States. It is worth noting that the inclusion of Teton County in the five-county region may bias the results upward, due to the higher cost of living in Jackson and other portions of Teton County. In other words, the rise in the cost of living for the four counties of the combined Cody and Worland Planning Area is likely to be lower than that suggested by the five-county region that also includes the affluent Teton County. In 2009, the cost of living declined slightly for all three geographic regions shown in the figure, as a result of the housing market decline and the nationwide recession. Since 2010, the trend of increase in the cost of living has resumed.

Figure 3-36. Cost of Living Trends in the Planning Area



Source: Wyoming Economic Analysis Division 2012a

Housing

Housing stock within the Planning Area grew steadily in all four counties from 2001 to 2008, particularly in Park County, with a somewhat less steady growth after 2008 (see Table 3-75). Data on vacancy rates for all housing are presented in Table 3-76, which also provides data on the percentage of housing that is occupied by renters and owners. This section also presents, later, updated data on rental vacancy rates.

Table 3-75. Housing Units, 2001-2011

County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Big Horn	5,131	5,144	5,163	5,196	5,227	5,227	5,240	5,253	5,278	5,378	5,376
Hot Springs	2,548	2,552	2,558	2,571	2,578	2,580	2,585	2,589	2,589	2,580	2,572
Park	12,041	12,151	12,310	12,499	12,716	12,881	13,108	13,320	13,491	13,588	13,666
Washakie	3,670	3,675	3,682	3,687	3,697	3,701	3,707	3,724	3,724	3,832	3,822

Sources: U.S. Census Bureau 2010d; U.S. Census Bureau 2013d.

Table 3-76 shows that about 70 to 75 percent of housing is owner occupied in all four counties. Vacancy rates in 2010 were highest in Big Horn and Hot Springs counties, where about one in six houses were vacant, and lowest in Washakie County, where about one in ten houses were vacant. The year 2010 vacancy rates suggest there was sufficient housing stock to accommodate new residents, at least in the aggregate.

Table 3-76. Housing Occupancy Status in 2010

County	Number of Housing Units	Percent Occupied	Percent Vacant	Percent Owner Occupied	Percent Renter Occupied
Big Horn	5,379	85%	15%	75%	25%
Hot Springs	2,582	85%	15%	70%	30%
Park	13,562	88%	12%	71%	29%
Washakie	3,833	91%	9%	73%	27%

Source: U.S. Census Bureau 2010e

Table 3-77 shows average housing prices for the Planning Area counties from 1998-2012, based on sales of existing, detached single family homes on 10 acres or less sold during the previous calendar year (WHDP 2009b; WHDP 2009a). Figure 3-37 shows the same information graphically. The table and figure show that housing prices in the Planning Area counties have increased in generally parallel fashion (i.e., growing at about the same rate) until 2008, although with prices consistently higher in Park County than the other three counties. The 2008 data show a dip in housing prices statewide due to the economic contraction. This dip continued in 2009, when it was also evident in Big Horn and Park counties, with less clear trends since then.

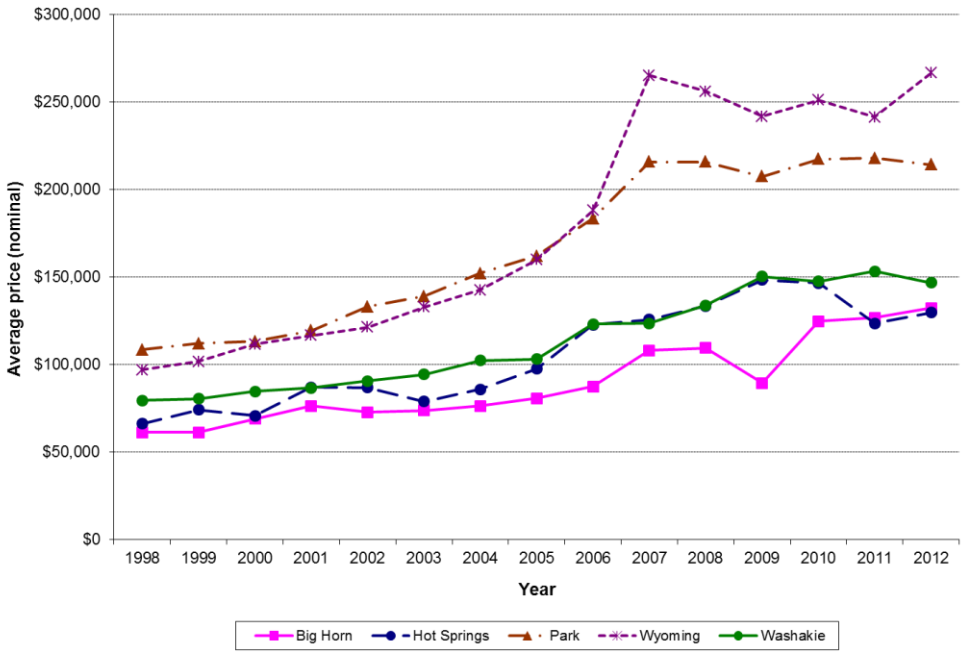
Table 3-77. Average Housing Price, 1998-2012

Year	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
1998	$61,088	$66,044	$108,286	$79,433	$96,906
1999	$61,022	$74,022	$111,893	$80,338	$101,517
2000	$68,816	$70,625	$113,178	$84,564	$111,437
2001	$76,263	$86,840	$119,233	$86,412	$116,469
2002	$72,670	$86,625	$132,854	$90,405	$121,140
2003	$73,526	$78,705	$138,941	$94,206	$132,708
2004	$76,279	$85,615	$151,921	$102,144	$142,501
2005	$80,607	$97,453	$161,866	$102,948	$159,776
2006	$87,384	$122,544	$183,326	$123,072	$187,869
2007	$107,966	$125,576	$215,697	$123,363	$265,044
2008	$109,295	$133,421	$215,692	$133,754	$256,045
2009	$89,239	$148,296	$207,333	$150,202	$241,622
2010	$124,608	$146,474	$217,191	$147,467	$250,958
2011	$126,574	$123,438	$217,902	$153,093	$241,301
2012	$132,077	$129,612	$214,019	$146,557	$266,406
Number of Sales in 2012	13	45	188	81	662

Sources: WHDP 2009b; WHDP 2009a; WHDP 2013.

Note: Prices are the average for all existing detached single family homes on 10 acres or less sold during the previous calendar year, and are not adjusted for inflation.

Figure 3-37. Average Housing Price, 1998-2012



Sources: WHDP 2009b; WHDP 2009a; WHDP 2013.

Table 3-78 shows information about rental housing availability (i.e., rental vacancy rates) since 2001. Vacancy rates in all four counties were somewhat volatile between 2001 and 2012, with some low years and some higher years. In 2007, vacancy rates in Big Horn, Park, and Washakie counties were generally low, except in December in Washakie County, but in 2008 they rose again. This increase generally continued in 2009 and 2010, with some exceptions. As of 2012, vacancy rates were highest in Hot Springs County and lowest in Washakie County.

Table 3-78. Rental Housing Availability

Year	Big Horn County		Hot Springs County		Park County		Washakie County	
	June/July	December	June/July	December	June/July	December	June/July	December
2001	12.2	12.1	5.4	6.4	3.6	6.4	4.9	9.5
2002	4.4	4.7	11.0	11.7	5.8	4.5	10.2	6.3
2003	6.9	5.0	10.6	9.9	2.5	6.9	5.9	6.3
2004	8.6	11.0	6.8	4.7	5.4	10.7	1.6	1.1
2005	6.2	8.4	8.3	6.8	3.3	5.2	3.1	1.6
2006	6.8	3.3	4.4	8.5	1.6	3.3	1.5	0.0
2007	2.1	1.5	5.4	5.3	1.0	2.7	1.0	7.3
2008	3.0	4.7	9.3	5.9	2.9	3.4	3.7	2.7
2009	4.9	14.2	5.9	8.1	2.8	3.5	3.9	3.5
2010	10.0	13.7	8.3	5.5	2.8	4.2	3.7	5.0
2011	4.4	5.7	10.8	7.6	2.7	2.8	3.6	2.1
2012	6.1	6.8	8.2	2.8	2.6	3.6	2.5	2.3

Sources: WHDP 2009b; WHDP 2009a; WHDP 2013.

Note: Availability is measured in percentage terms (percent of units that are vacant) based on a survey of rental agencies.

Table 3-79 provides some additional economic variables of interest. The ratio of relatively low-income households to relatively high-income households, which provides an indication of income inequality, is higher in Big Horn and Hot Springs counties than the median for all U.S. counties (indicating a more unequal income distribution), and lower in Park and Washakie counties (indicating a more equal distribution of income). The index of employment specialization is substantially higher in Big Horn and Hot Springs counties than the median for all U.S. counties, which indicates that employment in these counties is relatively concentrated in a small number of industry sectors. The same index shows that employment in Park and Washakie counties is slightly more diversified than in the United States as a whole. This kind of diversification can help to moderate boom and bust cycles when those cycles affect particular industries more than others. Finally, the net residential adjustment shows the degree to which commuting across county borders affects work-related earnings. Hot Springs County had a positive residential adjustment in 2005, indicating that more people commuted out of the county to work (the county is a "bedroom community"). The other counties in the Planning Area had negative residential adjustments, indicating that more people commuted into the county to work.

Table 3-79. Poor-Rich Ratio, Employment Specialization, and Residential Adjustment

Area	Poor-Rich Ratio (1999)[1]	Employment Specialization Index (2005)[2]	Net Residential Adjustment (2005)[3]
Big Horn County	11.8	267	-2.0%
Hot Springs	11.9	321	4.2%
Park County	7.8	146	-1.0%
Washakie County	6.0	139	-1.1%
Median of United States counties[4]	9.0	155	N/A

Sources: Headwaters Economics 2007a; Headwaters Economics 2007b; Headwaters Economics 2007c; Headwaters Economics 2007d.

[1]Measures the ratio of households with income less than $30,000 to those with income exceeding $100,000 (in year 1999). For instance, a ratio of 10 indicates there are 10 households with income less than $30,000 for every household with income over $100,000.
[2]A relative measure of the diversity of the employment base of a county compared to the employment base of the United States as a whole. A lower index indicates a more diverse employment base; a higher index indicates greater specialization (employment is more concentrated in a few economic sectors).
[3]A positive residential adjustment indicates that more people commute out of the county to work, while a negative adjustment indicates that more people commute into the county to work. The numeric value is the net proportion of total personal income that is earned across county lines.
[4]Represents the median for all counties in the United States (not the median value for the United States as a whole).

Tax Revenues

Economic activities on BLM-administered land and mineral estate contribute to the fiscal well-being of local governments, as well as to state and federal governments. The BLM's management actions have the potential to affect tax revenues from mining and mineral production; travel, tourism, and recreation; and livestock grazing and ranching.

Mineral Severance Taxes

The mining industry contributes substantially to state and local tax revenues. For example, the Wyoming State Auditor (Wyoming State Auditor 2012) reported that state mineral severance taxes and federal mineral royalties returned to the state represented 37 percent of total state revenues in Fiscal Year 2012 – a total of $1.58 billion. Table 3-80 shows estimated state severance tax collections for the Planning Area counties and Wyoming for production year 2010.

Table 3-80. Estimated State Severance Tax Collections in the Planning Area Counties, for Production Year 2010

Mineral	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Crude and Stripper Oil	$5,139,113	$7,607,647	$20,318,620	$1,960,048	$151,674,247
Natural Gas	$424,737	$35,696	$1,846,938	$433,986	$456,086,175
Coal	$0	$27,459	$0	$0	$281,395,969
Gypsum	$19,886	$0	$16,491	$0	$36,376
Sand and Gravel	$5,499	$1,059	$13,926	$2,806	$457,265
Bentonite	$697,849	$26,681	$0	$61,073	$1,283,195
Additional Minerals	$0	$0	$0	$0	$19,927,798
Total	**$6,287,083**	**$7,698,541**	**$22,195,975**	**$2,457,912**	**$910,861,025**

Source: Wyoming DOR 2012

Note: The application of various tax incentive statutes resulted in a reduced severance tax collection for oil (Wyoming DOR 2012). The figure for oil was calculated using the average of the actual severance tax rate in the previous two years (4.89 percent).

Federal mineral royalties are levied at 12.5 percent of the value of current oil and gas and coal production, after allowable deductions. Half the royalties collected are returned to the state of Wyoming, and a portion of the royalties received by the state are disbursed to cities and towns (State of Wyoming 2004). According to the Wyoming Consensus Revenue Estimating Group (CREG), federal mineral royalties for production in the state were $879 million in Fiscal Year 2010, $942 million in Fiscal Year 2011, and $955 million in Fiscal Year 2012 (CREG 2013). This includes royalties from oil, gas and gas plant products, and coal, including coal lease bonuses. Royalty revenues were lower than in previous years due to reduced drilling activity from the national recession and other factors. CREG projects a slight increase in the next few years (CREG 2013).

Local counties and communities receive severance taxes and federal mineral royalties. Table 3-81 lists the federal mineral royalties disbursements received by the Planning Area counties between 2004 and 2009, and Table 3-82 lists severance tax disbursements to these counties between 2004 and 2012. Small amounts of state severance taxes are also distributed to towns, but are not included in these figures.

Table 3-81. Disbursements of Federal Mineral Royalties by Planning Area Counties, for Production Years 2004-2009

Fiscal Year	Big Horn County	Hot Springs County	Washakie County	Park County	Total
2004	$2,555,612	$3,327,735	$1,491,388	$9,220,666	$16,595,401
2005	$4,656,727	$4,470,292	$1,651,277	$12,243,560	$23,021,856
2006	$4,945,953	$6,025,658	$4,659,127	$19,098,545	$34,729,283
2007	$3,688,612	$7,249,080	$3,302,493	$15,814,298	$30,054,483
2008	$6,127,423	$11,510,917	$4,568,479	$24,614,706	$46,821,524
2009	$4,163,525	$7,614,451	$2,485,727	$15,301,272	$29,564,975

Source: Schaeffer 2010

Table 3-82. Disbursements of Severance Tax by Planning Area Counties, for Production Years 2004-2012

Fiscal Year	Big Horn County	Hot Springs County	Washakie County	Park County	Total
2004	$176,732	$133,476	$169,798	$289,455	$769,461
2005	$164,947	$106,791	$150,672	$303,648	$726,057
2006	$173,411	$115,818	$163,855	$312,518	$765,602
2007	$178,450	$117,265	$174,591	$317,072	$787,378
2008	$169,861	$108,850	$163,584	$306,868	$749,163
2009	$156,170	$94,806	$146,158	$291,446	$688,580
2010	$160,673	$92,283	$154,392	$299,481	$706,829
2011	$157,206	$89,636	$149,965	$291,595	$688,402
2012	$149,931	$84,085	$141,686	$277,107	$652,809

Sources: Wyoming State Treasurer's Office 2010; Wyoming State Treasurer's Office 2011; Wyoming State Treasurer's Office 2012; Wyoming State Treasurer's Office 2013.

Property Tax and Sales Tax Base (Tax Revenues)

Another way to look at the contributions of different industries in the Planning Area is to consider how different economic sectors contribute to local and state property values for the purpose of property tax levies, and also to local and state sales taxes. The fiscal stability of local and state government, as well as the economic viability of communities themselves, depends on the viability and stability of local industry and commerce. Table 3-83 shows local and state assessed property valuation in 2012 for the Planning Area counties and Wyoming. Table 3-84 shows local and state sales tax revenues by sector for each of the counties.

Table 3-83. Local and State Assessed Property Valuation, 2012

County	Total ($ millions)	Agricultural	Residential	Commercial	Mineral	Industrial
Local Assessed Valuation						
Big Horn County	$90	17%	59%	15%	5%	5%
Hot Springs County	$45	8%	58%	17%	15%	2%
Park County	$336	5%	73%	16%	4%	2%
Washakie County	$78	10%	59%	16%	5%	10%
State of Wyoming	$7,640	3%	55%	15%	24%	2%
State Assessed Valuation						
Big Horn County	$192	0%	0%	0%	94%	6%
Hot Springs County	$203	0%	0%	0%	95%	5%
Park County	$563	0%	0%	0%	97%	3%
Washakie County	$70	0%	0%	0%	84%	16%
State of Wyoming	$17,602	0%	0%	0%	92%	8%
Total (State and Local) Assessed Valuation						
Big Horn County	$282	5%	19%	5%	66%	5%
Hot Springs County	$248	1%	11%	3%	81%	4%
Park County	$899	2%	27%	6%	62%	3%
Washakie County	$148	5%	31%	8%	43%	13%
State of Wyoming	$25,243	1%	17%	5%	71%	6%

Source: Wyoming DOR 2012

Table 3-84. State and Local Sales Tax Collections by Sector, 2012

Sector	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Agriculture, Forestry, Fishing, and Hunting	0.03%	0%	0.1%	0.1%	0.04%
Mining	17%	12%	6%	9%	19%
Utilities	8%	9%	6%	7%	4%
Construction	2%	1%	1%	1%	2%
Manufacturing	3%	1%	3%	3%	3%
Wholesale Trade	15%	9%	6%	9%	11%
Retail Trade	27%	35%	41%	35%	31%
Transportation and Warehousing	0.1%	-1%	-0.1%	0.03%	0.1%
Information	4%	4%	2%	6%	2%
Financial Activities	3%	2%	3%	4%	5%
Professional and Business Services	1%	0.3%	1%	1%	1%
Educational and Health Services	0.01%	0.03%	0.1%	0.01%	0.1%
Leisure and Hospitality	5%	14%	18%	9%	10%
Other Services	6%	4%	3%	5%	5%
Public Administration	8%	9%	9%	10%	6%
Total ($ millions)	**$8.2**	**$4.6**	**$23.2**	**$8.2**	**$857.8**

Source: Wyoming Economic Analysis Division 2012b

Note: A negative value indicates a refund larger than collections.

Together, the data on sales tax collections and that on property tax valuations by sector provide insight into the economic base of the counties. Retail trade contributes the largest share of sales tax revenues in all four counties. Large shares are also contributed by several other sectors: wholesale trade, utilities, mining, leisure and hospitality, and public administration. Mineral and mining-related property provides the most important contributor to state and local assessed valuation for property taxes, with residential property the second most important contributor.

Separate data on sales tax revenues from retail trade, accommodation, and food sales (Table 3-85) provide some additional insight into the contribution from elements related to travel and tourism, specifically: eating and drinking places and lodging. (A portion of tax collections from eating and drinking places also accrue from local residents, and a portion of gasoline station tax collections would also accrue from tourists and business travelers.) These data suggest that travel and tourism provide an important contribution to sales tax collections in the Planning Area counties.

Dean Runyan Associates, working for the Wyoming Office of Travel and Tourism, estimated that statewide in 2011, travel and tourism from business and recreational visitors accounted for $68 million in state sales, use, and lodging tax revenues and $52 million in local sales, use, and lodging tax revenues, not including property tax collections related to recreation infrastructure (Dean Runyan Associates 2012). This estimate is based on the data above, as well as additional survey data from a variety of sources. Table 3-86 shows tax receipts due to travel and tourism for the counties in the Planning Area.

Local taxes include room taxes, local sales taxes, and the local share of state taxes. State taxes include the state share of the sales tax and the state motor fuel tax (Dean Runyan Associates 2012).

Table 3-85. Retail, Accommodation, and Food Sales: State and Local Sales Tax Collections, 2012

Sector	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Auto Dealers and Parts	10%	2%	5%	13%	10%
Building Material and Garden Supplies	19%	37%	14%	18%	15%
Clothing and Shoe Stores	1%	1%	3%	2%	3%
Department Stores	1%	0.2%	2%	0.4%	3%
Eating and Drinking Places	12%	16%	18%	14%	16%
Electronic and Appliance Stores	5%	2%	3%	4%	4%
Gasoline Stations	18%	6%	4%	4%	7%
General Merchandise Stores	5%	7%	14%	11%	13%
Grocery and Food Stores	9%	4%	5%	7%	3%
Home Furniture and Furnishings	2%	1%	2%	3%	2%
Liquor Stores	0.5%	1%	2%	1%	2%
Lodging Services	4%	11%	12%	5%	8%
Miscellaneous Retail	14%	11%	19%	18%	15%
Total ($ millions)	**$2.7**	**$2.2**	**$13.6**	**$3.6**	**$351.6**

Source: Wyoming Economic Analysis Division 2012b

Table 3-86. Local and State Tax Receipts Due to Travel and Tourism in Wyoming, 2012 ($ millions)

Locality	Local Tax Receipts	State Tax Receipts
Big Horn County	$0.3	$0.8
Hot Springs	$0.4	$0.7
Park County	$3.7	$5.6
Washakie County	$0.2	$0.5
State of Wyoming	$52.0	$68.0

Source: Dean Runyan Associates 2012

Table 3-87 provides trends of local and state tax receipts due to travel and tourism for the Planning Area counties from 2004 through 2011. Note that the data in the table are in current dollars, that is, are not adjusted for inflation. The table shows that local and state tax receipts rose slowly between 2004 and 2008 for all four Planning Area counties and for the state, then dipped slightly in 2009 for the state (but generally remained stable in the four Planning Area counties) and has remained relatively stagnant since, with the exception of a small increase in Park County. Among the four counties, tax receipts are also consistently highest in Park County.

Table 3-87. Local and State Tax Receipts Due to Travel and Tourism, 2004-2011 ($ millions)

County	2004	2006	2008	2009	2010	2011
Local Tax Receipts						
Big Horn	$0.2	$0.3	$0.3	$0.3	$0.3	$0.3
Hot Springs	$0.3	$0.4	$0.5	$0.4	$0.5	$0.4
Park	$2.4	$2.7	$3.3	$3.3	$3.6	$3.7
Washakie	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2
Wyoming	$33.0	$41.0	$45.0	$43.0	$45.0	$52.0
State Tax Receipts						
Big Horn	$0.7	$0.7	$0.8	$0.8	$0.8	$0.8
Hot Springs	$0.5	$0.7	$0.7	$0.7	$0.7	$0.7
Park	$4.2	$4.4	$5.3	$5.3	$5.6	$5.6
Washakie	$0.4	$0.4	$0.5	$0.5	$0.5	$0.5
Wyoming	$53.0	$63.0	$71.0	$66.0	$65.0	$68.0

Source: Dean Runyan Associates 2012

Note: Data are in current dollars (i.e., are not adjusted for inflation).

3.8.3 Health and Safety

The BLM's Hazard Management and Resource Restoration Program addresses a variety of hazards on public surface to reduce risks to visitors and employees. Hazards may include hazardous materials; mine shafts and adits; abandoned equipments and structures; explosives and munitions; and spills from pipelines, tankers, and storage tanks. Activities directed toward health and safety concerns in the Planning Area primarily encompass AMLs, natural geologic hazards, and hazardous wastes and materials.

Natural geologic hazards include landslides and earthquakes. A wide range of permitted uses that occur on BLM-administered public lands have the potential to introduce hazardous substances and petroleum products into the environment.

Abandoned Mine Lands

Extreme physical hazards are common at abandoned mine sites, and for visitors, these hazards are not always apparent. Abandoned mine sites have proven to be a luring and sometimes life-threatening attraction for both children and adults. Serious injury or death can occur at these sites. The presence of such sites can compromise other land uses and land quality. The following paragraphs identify some of the common physical hazards posed by AML sites (Wyoming DEQ, Abandoned Mine Land Division 2009a).

Horizontal openings: The mine opening (known as a portal or adit) might seem stable, but rotting timbers and unstable rock formations make cave-ins a real danger. The darkness and debris in old mines make identification of the hazards difficult.

Vertical shafts: These can be hundreds of feet deep. At the surface, openings can be hidden by vegetation or covered by rotting boards or timbers. Inside old mines, shafts can be camouflaged by debris or hidden by darkness in the mine.

Explosives and toxic chemicals: Blasting caps, dynamite, and chemicals were often left behind when the mine workings were abandoned. Explosives become unstable with age, and can be detonated by the vibration of footsteps. Abandoned chemicals such as cyanide, arsenic, mercury, and other deadly toxins could be present in leaking and deteriorating containers.

Dangerous gases: Lethal concentrations of CH_4, CO, CO_2, and H_2S (to name a few) can accumulate in underground passages. Oxygen-deficient air can cause suffocation. People have died within a few feet of the mine openings.

Water: Impounded water can be highly alkaline or acidic (resulting in skin burns), and deep and cold (contributing to hypothermia).

Spoil (rock and dirt) piles: These loose piles can collapse or slide, burying an unsuspecting victim.

Equipment and buildings: Abandoned surface structures and old mine equipment can collapse on bystanders.

Highwalls: These are the excavated vertical cliffs in surface pits and quarries. They can be unstable and prone to collapse. Highwalls might not be visible from the top, presenting a danger to off-road drivers.

Radon: Radon is a natural radioactive decay product and is known to be a factor in some lung cancers. Radon can accumulate in high concentrations in poorly ventilated mines.

Wildlife: Rattlesnakes, bears, cougars, and other wildlife frequent old mine sites.

Disorientation: There is no natural light inside mine workings. Many mine workings meandered as miners followed an ore vein. It is easy to get lost and become disoriented in a maze of mine workings, especially if lighting equipment fails.

Mine fire areas: Mine fires create surface hazards in abandoned coal mine areas. As fires burn within the seam, fissures can open to the surface and deliver deadly gases into the atmosphere. The area around the fissure might not be capable of supporting the weight of a human or vehicle, and could collapse into the burning coal or the mine void.

Abandoned mines are a common feature on BLM-administered lands. Approximately 380 potential AML sites have been identified in the Planning Area based on site data from a Wyoming DEQ, AML Division, database; more than 30 of those sites were visited and found to have no trace of past mining activity (Wyoming DEQ, Abandoned Mine Land Division 2008). Map 95 identifies potential AML sites in the

Planning Area. Potential sites are identified using published information, maps, aerial photography, and reporting by the public and surface management agencies. The Wyoming DEQ, AML Division, is performing a quality assurance review to update information on AML sites that have undergone reclamation; therefore, the location and number of reclaimed sites in the Planning Area cannot be accurately assessed at this time.

The BLM Wyoming State Office has a prioritized list of AML sites that pose the greatest risk to people and the environment. AML sites affecting water quality are addressed using the watershed approach. Using this approach accomplishes the following objectives:

- Allows for mitigation to be risk-based by identifying priority sites first.
- Fosters collaborative efforts across federal, state, and private administrative boundaries.
- Considers all issues important to water resource protection.
- Reduces the cost of mitigation.
- Provides the most efficient method of remediating AML sites by utilizing a wide range of available resources.

Recently, several AML sites in the Planning Area were identified, inventoried, and reclaimed. Abandoned sulfur mine workings, and a dangerous embankment related to pre-law gypsum mining, were reclaimed in 2006 and 2007. A current AML project involves identifying and inventorying old coal mine workings in the Bighorn Basin. In 1999, the BLM and the Wyoming DEQ, AML Division, signed a cooperative agreement that further facilitated the reclamation of AML sites on BLM-administered lands. The state program, as required by the Surface Mining Control and Reclamation Act of 1977, focuses on public safety hazards. In addition, the BLM has received some funding for its soil, water, and air program to address site-specific environmental hazards and watershed concerns associated with abandoned mines. By combining available funding, the BLM can continue to comprehensively address safety hazards and environmental impacts to water quality and watershed function at priority AML sites. In this collaborative partnership approach, the BLM and the Wyoming DEQ, AML Division, are undertaking several AML reclamation projects on public lands in the Planning Area.

The Wyoming DEQ, AML Division, works closely with federal land management agencies, private land owners, and the general public to ensure that the views of all interested parties are considered in the reclamation process. According to an August 2007 fact sheet, the Wyoming DEQ, AML Division, operated with an approximately $109 million budget in 2008, and a projected $69 to $149 million annual budget for calendar years 2009 through 2015 (Wyoming DEQ, Abandoned Mine Land Division no date). The Wyoming DEQ, AML Division, will use these funds to identify and reclaim AMLs and to construct public works projects in communities adversely affected by mining activities. According to the Wyoming DEQ, AML Division, Coordinator, the state AML program will focus on abandoned coal mines in the foreseeable future (Wyoming DEQ, Abandoned Mine Land Division 2009b). The BLM will continue to identify and remediate the hazards of abandoned mines, in concert with the Wyoming DEQ, AML Division and on its own.

Natural Geologic Hazards

Natural geologic hazards (geo-hazards) include active fault or seismic zones; areas prone to landslides; subsidence due to coal fires; over-pressured subsurface oil, gas, or groundwater zones; and potentially toxic minerals and assemblages such as selenium; and shrinking and swelling clay soils. There are several naturally occurring geologic hazards in the Planning Area. These include primarily down-slope

movements such as slumps, landslides and rock-fall, and flood-related hazards, shrinking and swelling clays, and potentially seismic zones.

Earthquakes and landslides are generally identified and forecast through USGS earthquake and landslide hazards programs. The Wyoming Geological Survey Surficial Processes/Geological Hazards Section is dedicated to the study and publication of information about geologic hazards in the state of Wyoming. There is a large amount of information about the likelihood of numerous natural geological hazards on the Wyoming Geological Survey and USGS websites.

Gravity influences soils and loose rock or colluvium on slopes in the Planning Area. When these materials are saturated with water, they can creep slowly down slopes or move suddenly with devastating results. Rapidly moving landslides can be triggered by a rainstorm or a seismic event such as an earthquake. Earthquakes of varying magnitude have affected the Bighorn Basin over time. Other types of natural geologic hazards affecting the Planning Area include active faults, shrinking and swelling soils, and flooding.

The occurrence of landslides depends directly on slope stability and precipitation quantities (normal versus drought conditions). Therefore, the recent drought has led to a decrease in landslides in the Planning Area.

Hazardous Wastes and Materials

The BLM investigates spills, illegal dumping, and hazardous materials releases to determine the need for immediate cleanup or other long-term remediation actions. This often involves working with the EPA, the Wyoming DEQ, and potentially responsible parties to fund and expedite the cleanup of hazardous sites and disposal activities that result from recreational use and industrial activities such as oil and gas development. The field offices in the Planning Area have an effective hazard management and resource restoration program.

There have been 31 response actions on public lands in the Planning Area since 1993 – 8 incidents involving the illegal disposal of unknown substances, more than 12 incidents of wire burns, 5 incidents involving abandoned facilities with the potential for the release of hazardous substances, 1 polychlorinated biphenyl spill, 2 incidents involving the discovery of explosives, and 3 incidents involving potential unexploded seismic charges.

Landfill management also has been a health and safety priority for the last 20 years. Six permitted municipal landfills in the Planning Area (Burlington, Hyattville, Manderson, Thermopolis, Shell, and Westside) have closed during this period, as have three industrial landfills (two permitted to the Marathon Oil Company in Grass Creek and Gebo for oil field refuse and one permitted to Georgia-Pacific Corporation for a bentonite mine and sheet rock manufacturing facility near Lovell). Three operating landfills (Worland, South Bighorn, and Ten Sleep) have transferred from federal to local ownership. The Cody landfill is in the process of transfer to Park County. The Wyoming DEQ, Hazardous and Solid Waste Division, is investigating all operating and closed landfills for groundwater contamination.

Due to the pollution hazards associated with shooting ranges, ranges permitted on public lands in the Planning Area are also being transferred out of federal ownership. The Worland shooting range was transferred into private ownership in 2000. Additionally, the Cody Shooting Complex was transferred to Park County in 2010, and the Powell Shooting Complex was transferred to the Powell Recreation District in 2014.

Increased awareness has led employees and the public to report more hazmat incidents. This awareness and reporting has led to the cleanup of old dump sites and abandoned facilities.

3.8.4 Environmental Justice

Minority Populations

BLM IM 2002-164, Guidance to Address Environmental Justice in Land Use Plans and Related NEPA Documents provides policy and guidance for addressing environmental justice in BLM land use planning (BLM 2002b). IM 2002-164 defines minority persons as "Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-white persons." Furthermore, IM 2002-164 states that an area should be considered to contain a minority population where the minority population of the affected area exceeds 50 percent, or the percentage of minority population in the affected area is meaningfully greater than the percentage in the general population.

Populations of the four counties in the Planning Area are predominantly white and non-Hispanic. Table 3-88 lists the percentage of minority population in the counties in the Planning Area in 2000 and 2010, and the percentage of people in poverty in 2000 and in the 2007-2011 five year period. This five year period was used because poverty data for towns (discussed further below) is only available from the five-year American Community Survey. Although minority populations increased slightly from 2000 to 2010, three of the four counties have a larger proportion of non-Hispanic white residents than do the state or the country. Washakie County is the sole exception; it has a slightly higher proportion of non-Hispanic white residents than the state, although a lower proportion than the United States. Poverty data are discussed later in this section.

Table 3-88. Minority Populations in 2000 and 2010; Low-Income Populations in 2000 and 2007-2011 by County

County	Percent Minority Population in 2000	Percent Minority Population in 2010	Percent in Poverty in 2000	Percent in Poverty in 2007-2011
Big Horn County	8	11	14	9
Hot Springs County	5	5	11	14
Park County	5	7	13	9
Washakie County	14	16	14	9
State of Wyoming	11	14	11	10
United States	31	36	12	14

Sources: U.S. Census Bureau 2000; U.S. Census Bureau 2010f; U.S. Census Bureau 2011c.

Table 3-89 lists population by race and ethnicity by town in the Planning Area in 2000 and 2010. The table shows that there is important variation in minority population percentages in the counties, because some individual towns have higher (and lower) percentages of minority residents compared to their respective counties. In 2000, Worland, Burlington, Powell, Greybull and Byron had the largest percentages of minority residents, and Ten Sleep, Meeteetse, and Kirby had the smallest percentages. The table also shows that in eleven of the seventeen towns in the Planning Area, the percent of minority residents increased between 2000 and 2010.

Table 3-89. Minority and Low-Income Populations in 2000 and 2010 by Counties and Towns in the Planning Area

County/Town	Percent Minority Population in 2000	Percent Minority Population in 2010	Percent in Poverty in 2000	Percent in Poverty in 2010
Big Horn County	8	11	14	9
Basin	5	9	12	6
Burlington	12	15	15	11
Byron	15	13	23	21
Cowley	4	5	7	5
Deaver	10	7	10	9
Frannie	8	12	7	28
Greybull	7	13	15	11
Lovell	11	13	15	7
Manderson	8	11	14	13
Hot Springs County	5	5	11	14
East Thermopolis	9	7	17	14
Kirby	9	4	12	0
Thermopolis	6	5	10	19
Park County	6	7	13	9
Cody	4	6	14	11
Meeteetse	4	4	11	10
Powell	8	13	20	11
Washakie County	14	16	14	9
Ten Sleep	1	3	7	13
Worland	16	19	15	11
State of Wyoming	11	14	11	10

Sources: U.S. Census Bureau 2000; U.S. Census Bureau 2010f; U.S. Census Bureau 2011c.

Table 3-90 lists population by race and ethnicity in the Planning Area for major racial and ethnic groups. The largest ethnic or racial group other than non-Hispanic whites in any of the counties is Hispanic or Latino (of any race). In all four counties in the Planning Area, the percent of people in this ethnic group is lower than for the state as a whole. Most ethnic and racial groups other than non-Hispanic white comprise a very small proportion of populations in Planning Area counties. Note that Hispanic/Latino denotes an ethnicity, and people of this ethnic background can be of any race.

Table 3-90. Racial and Ethnic Groups in Planning Area Counties and Wyoming, 2010 (percent)

Race or Ethnicity	Big Horn County	Hot Springs County	Park County	Washakie County	State of Wyoming
Non-Hispanic, White	89	95	93	84	86
Non-Hispanic, Black	0.2	0.2	0.2	0.3	1
Non-Hispanic, American Indian/ Alaska Native	1	1	1	1	2
Non-Hispanic, Asian, Native Hawaiian, or Other Pacific Islander	0.3	0.4	1	1	0.1
Non-Hispanic, two or more races	1	1	1	1	2
Hispanic or Latino (of any race)	8	2	5	14	16

Source: U.S. Census Bureau 2010f

Low-Income Populations

BLM IM 2002-164 states that low-income populations can be identified according to poverty thresholds published by the U.S. Census Bureau. In addition, the IM notes that "when considering these definitions, it is important to recognize that some low-income and minority populations may comprise transitory users of the public lands and thus not associated with a particular geographic area" (BLM 2002b).

The Council on Environmental Quality (CEQ) guidance for environmental justice analysis under NEPA defines a "low-income population" as "either a group of individuals living in geographic proximity to one another, or a set of individuals (e.g., migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect" (CEQ 1997a). Although CEQ guidance does not provide a quantitative threshold (e.g., a limit on the percent of persons in poverty) for determining whether a population should be considered low-income, typically the percent of persons in poverty in the Planning Area is compared to that in a larger area such as the state. CEQ and BLM guidance do not specify quantitative criteria for what constitutes a low-income population.

As Table 3-88 shows, the percentage of people with income below the poverty level ranged between 9 and 14 percent for all counties in the Planning Area in the 2007-2011 period, and three of the four counties saw a reduction in poverty from 2000 to 2007-2011 (all except Hot Springs, in which the percent of people in poverty increased). In all but Hot Springs County, the percentage of people in poverty in 2007-2011 was slightly lower than in the state as a whole. In Hot Springs County the percentage of people in poverty in 2007-2011 was higher than in the state as a whole and similar to that in the United States as a whole.

The town-level data in Table 3-89 also show reductions in the percentage of people living in poverty in most towns between 2000 and 2007-2011. Because town-level data have a considerable margin of error, these data must be understood as the best data available, but very imprecise indicators of the actual poverty levels in towns. Based on these data, concentrations of people living in poverty were present in Byron, Frannie, and Thermopolis where the percentage of people in poverty exceeded averages for both the United States and the State of Wyoming.

3.8.5 Tribal Treaty Rights

Tribal roles and responsibilities are not well defined in the Planning Area. The Wind River Reservation, Wyoming's only reservation, houses two federally recognized tribes, the Eastern Shoshone and the Northern Arapaho. Although the modern boundaries of the reservation do not coincide with the Planning Area, historically, reservation boundaries entered into the Planning Area. The Wind River Reservation formerly extended along Owl Creek to its confluence with the Bighorn River in what is now Hot Springs County. The Crow Reservation in Montana formerly extended south to Shell Creek in what is now Big Horn County. At present, there are no identified treaty rights in the Planning Area. The BLM is committed to working with tribes as cooperating agencies and in formal consultations.

Judicially established lands are defined based on information provided by the Indian Claims Commission and approximating tribal lands that are determined by ethnographic and historic literature. The National Park Service (NPS 1993) indicates that the Crow judicially established lands encompass the Planning Area. Other tribes have judicially established land near, but outside, Planning Area boundaries. Although tribes have not explicitly identified traditional use areas in the Planning Area, this does not mean that such areas do not exist. Some site types present in the Planning Area, including rock art, form an integral part of traditional practices.

The following tribal political entities have expressed interest in consulting with the CYFO and the WFO regarding Native American issues and concerns. In some cases, if the tribe is willing, the BLM is developing MOUs regarding consultation for activities in the Planning Area.

- Blackfeet, living on the Blackfeet Reservation, Browning, Montana.
- Crow, living on the Crow Reservation, Crow Agency, Montana.
- Nez Perce, living on the Nez Perce Reservation, Lapwai, Idaho.
- Northern Arapaho, living on the Wind River Reservation, Fort Washakie, Wyoming.
- Northern Cheyenne, living on the Northern Cheyenne Reservation, Lame Deer, Montana.
- Salish and Kootenai, living on the Flathead Reservation, Pablo, Montana.
- Shoshone, represented by two tribes (Eastern Shoshone, living on the Wind River Reservation, Fort Washakie, Wyoming; Shoshone Bannock, living on the Fort Hall Reservation, Fort Hall, Idaho).
- Sioux, represented by three tribes (Cheyenne River Sioux living on the Cheyenne River Reservation, Eagle Butte, South Dakota; Oglala Sioux, living on the Pine Ridge Reservation, Pine Ridge, South Dakota; Rosebud Sioux, living on the Rosebud Reservation, Rosebud, South Dakota).

There are no trust lands, reservation lands, or tribal properties in the Planning Area. A number of treaties and policies did affect tribes in the region, but existing conditions do not reserve any lands or rights in the Planning Area. Treaties and policies included the First Treaty of Fort Laramie, the Blackfeet Treaty of 1855, the Hellgate Treaty, the Homestead Act of 1862, the Second Treaty of Fort Laramie, the Sioux Act of 1888, the Dawes Act, and the Indian Reorganization Act of 1934.

Trust Responsibilities

Secretarial Order No. 3215, "Principles for the Discharge of the Secretary's Trust Responsibility" (April 28, 2000) defines trust responsibility as responsibility toward Indian trust assets, which it defines as "lands, natural resources, money, or other tangible assets held in trust for Indian tribes and individual Indians or restricted against alienation." Therefore, the BLM "has overall responsibility for establishing, implementing, and evaluating policy for meeting…tribal consultation responsibilities" (BLM 2004e). This obligation requires a reasonable and good faith effort to identify and consider, and to carry out programs in a manner sensitive to and consistent with, Native American concerns and tribal government planning and resource management programs.

Treaty Rights and Trust Responsibilities Policy

A treaty is a formal agreement between the U.S. Government and a Native American tribe or tribes that cede land or reserve rights to the tribe(s). Executive Order 13084, Consultation with Indian Tribal Governments, and Executive Order 13007, Indian Sacred Sites, provide the framework for involving Native American tribes in the BLM planning process. BLM Manual 8120, Tribal Consultation Under Cultural Resource Authority, provides additional guidance (BLM 2004e).

Although there are no tribal government lands in the Planning Area, the BLM consults with tribes who have expressed interest in or concerns about the Planning Area to determine which groups intend to continue with government-to-government consultations. This process is ongoing.

3.9 Climate Change

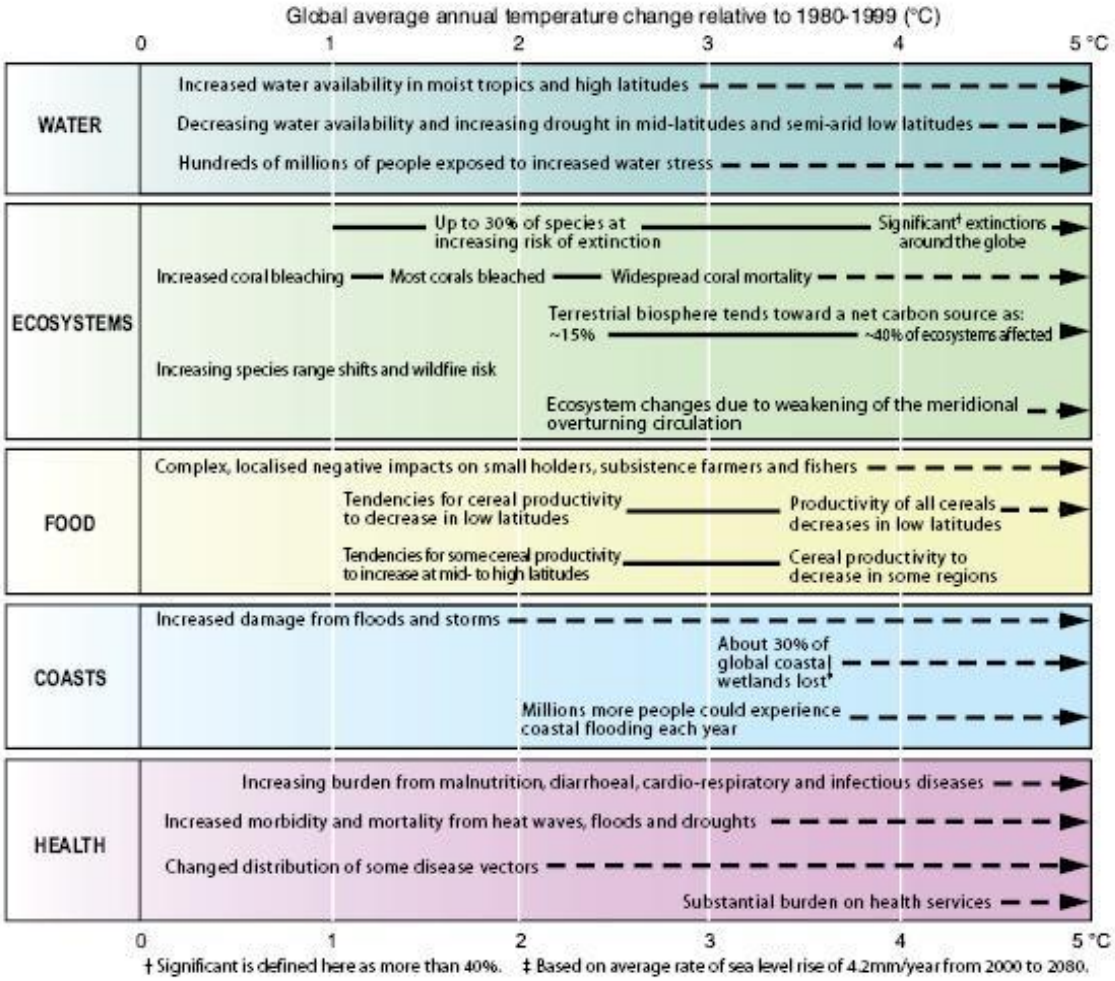
A growing body of evidence indicates that Earth's atmosphere is warming. Records show that surface temperatures in the Wyoming region have risen approximately 1.5°F since the 1960 to 1979 baseline years (Global Change Research Program 2009). The largest increase in average temperature has occurred in the winter months in the northern portions of the region. Relatively cold days in the region are becoming less frequent and relatively hot days are becoming more frequent (Global Change Research Program 2009). Observed changes in oceans, ecosystems, and ice cover are consistent with this warming trend (National Academy of Sciences 2006). Ongoing scientific research has identified the potential impacts of GHG emissions, including CO_2, CH_4, nitrous oxide (N_2O), water vapor and several trace gases, on global climate change. Through complex interactions at regional and global scales, these GHG emissions cause a net warming of the atmosphere (which makes surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy Earth radiates back into space. Although GHG concentrations in the atmosphere and climatic conditions have varied throughout Earth's history, recent industrialization and burning of fossil fuels has caused global atmospheric CO_2 concentration to increase dramatically; this most recent CO_2 increase is likely to contribute to overall climatic changes (National Academy of Sciences 2006).

Global atmospheric concentrations of CO_2, CH_4, and N_2O have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values (as determined from ice cores spanning many thousands of years). The global increase in CO_2 concentrations is due primarily to fossil fuel use and land use change, while those of CH_4 and N_2O are due to agricultural soil management, animal manure management, sewage treatment, and mobile and stationary combustion of fossil fuels (IPCC 2007a, EPA 2009).

According to climate change researchers, the effects of climate change are expected to vary by region, season, and time of day (National Academy of Sciences 2006, Global Change Research Program 2009). Computer model forecasts indicate that increases in temperature will not be evenly or equally distributed, but are likely to be accentuated at higher latitudes. Warming during winter is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures (National Academy of Sciences 2006). Within a given region, increasing temperatures also could affect the amount of water vapor in the atmosphere, the timing and amount of precipitation, the intensity of storm systems, snow melt, and soil moisture. All of these factors can affect climate, day-to-day weather conditions, and air quality in the Planning Area.

Based on research compiled for the International Panel on Climate Change Fourth Assessment Report, 2007, (IPCC 2007a) potential effects of climate change on resources in the affected environment are likely to be varied. Figure 3-38, taken from the Fourth Assessment Report indicates varying responses of the natural world to increasing temperatures as a result of increasing global temperatures.

Figure 3-38. Examples of Impacts Associated with Global Average Temperature Change



Source: IPCC 2007a

Within North America, the report specifically forecasts that: warming in western mountains is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources; in the early decades of the century, moderate climate change is projected to increase aggregate yields of rain-fed agriculture by 5 to 20 percent, but with important variability among regions; major challenges are projected for crops that are near the warm end of their suitable range or which depend on highly utilized water resources; cities that currently experience heat waves are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts; and coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution. Specific modeling and/or assessments of the potential effects for the Bighorn Basin and for the state of Wyoming currently do not exist.

All of North America is likely to experience an increase in average temperature during the next 100 years, and annual mean warming is likely to exceed global mean warming in most areas (IPCC 2007a). Temperatures in the Planning Area are projected to increase substantially by the end of this century

(Global Change Research Program 2009). Summer temperatures in the Planning Area are expected to increase between approximately 7°F and 10+°F by 2080 to 2099. Overall, temperature in the region that includes the Planning Area is projected to increase between 2.5°F to more than 13°F compared to the 1960 to 1979 baseline, depending on future GHG emissions (Global Change Research Program 2009). This range of temperature increase reflects the current uncertainty in climate change modeling and represents the likely range of model projections, although lower or higher outcomes are possible.

The lack of scientific tools (models with sufficient spatial and temporal resolution) to forecast climate change even at regional scales limits the ability to quantify current and future impacts of climate change in the Planning Area. The following paragraphs describe potential future effects of climate change that can be reasonably anticipated for the Planning Area; however, some of these effects might already be occurring in the area.

Increasing temperatures in the Planning Area are likely to contribute to increased evaporation, drought frequencies, and declining water quantity. The warming of lakes and rivers will adversely affect the thermal structure and water quality of hydrological systems, which will add additional stress to water resources in the region (IPCC 2007b). The Planning Area depends on temperature-sensitive springtime snowpack to meet demand for water from municipal, industrial, agricultural, recreational uses and BLM-authorized activities. The USGS notes that mountain ecosystems in the western United States are particularly sensitive to climate change, especially in the higher elevations, where much of the snowpack occurs, which have experienced three times the global average temperature increase over the past century (USGS 2010). Higher temperatures are causing more winter precipitation to fall as rain rather than snow, which contributes to earlier snowmelt. Additional declines in snowmelt associated with climate change are projected, which would reduce the amount of water available during summer (Global Change Research Program 2009). Rapid spring snowmelt due to sudden and unseasonal temperature increases can also lead to greater erosive events and unstable soil conditions.

Increases in average summer temperatures and earlier spring snowmelt in the Planning Area are expected to increase the risk of wildfires by increasing summer moisture deficits (Global Change Research Program 2009). Studies have shown that earlier snowmelts can lead to a longer dry season, which increases the incidence of catastrophic fire (Westerling et al. 2006). Together with historic changes in land use, climate change is anticipated to increase the occurrence of wildfire throughout the western United States.

There is evidence that recent warming is impacting terrestrial and aquatic biological systems (IPCC 2007b). Warming temperatures are leading to earlier timing of spring events such as leaf-unfolding, bird migration, and egg-laying (IPCC 2007b). The range of many plant and animal species has shifted poleward and to higher elevation, as the climate of these species' traditional habitat changes. As future changes in climate are projected to be even greater than those in the recent past, there will likely be even larger range shifts in the coming decades (Lawler et al. 2009). Warming temperatures are also linked to earlier "greening" of vegetation in the spring and longer thermal growing seasons (IPCC 2007b). In aquatic habitats, increases in algal abundance in high-altitude lakes have been linked to warmer temperatures, while range changes and earlier fish migrations in rivers have also been observed (IPCC 2007b). Climate change is likely to combine with other human-induced stress to further increase the vulnerability of ecosystems to other pests, invasive species, and loss of native species. Climate change is likely to affect breeding patterns, water and food supply, and habitat availability to some degree. Sensitive species in the Planning Area, such as the sage-grouse, which are already stressed by declining habitat, increased development and other factors, could experience additional pressures as a result of climate change.

More frequent flooding events, erosion, wildfires and hotter temperatures all pose increased threats to cultural and paleontological sites and artifacts. Heat from wildfires, suppression activities and equipment, as well as greater ambient daytime heat can damage sensitive cultural resources. Similarly, flooding and erosion can wash away artifacts and damage cultural and paleontological sites. However, these same events may also uncover and lead to discoveries of new cultural and paleontological localities.

Climate change also poses challenges for many resource uses on BLM-administered land. Increased temperatures, drought and evaporation may reduce seasonal water supplies for livestock and could impact forage availability. However, in non-drought years, longer growing seasons resulting from thermal increases may increase forage availability throughout the year. Shifts in wildlife habitat due to climate change may influence hunting and fishing activities, and early snowmelt may impact winter and water-based recreational activities. Drought and resulting stress on vegetation could increase the frequency and intensity of mountain bark beetle and other insect infestations, which further increases the risk of fire and reduces the potential for sale of forest products on BLM-administered lands.

A variety of activities in the Planning Area currently generate GHGs. Fuels combustion, industrial processes and any number of other activities on public lands result in direct emissions of GHGs. Direct emissions in the Planning Area include those related to current and ongoing oil and gas and other minerals development, fire events, motorized vehicle use (e.g., OHVs), livestock grazing, facilities development, and other fugitive emissions. Indirect GHG emissions in the Planning Area include the demand for electricity generated outside the area. Contributions to climate change also result from land use changes (conversion of land to less reflective surfaces that absorb heat, such as concrete or pavement), and soil erosion (which can reduce snow's solar reflectivity and contribute to faster snowmelt).

Climate change science and projections of climate change is a continually growing and emerging science. Additional and recent information on climate change and regional projections of climate change for the Planning Area can be found through the following links:

- U.S. Global Change Research Program: http://www.globalchange.gov/
- Intergovernmental Panel on Climate Change (IPCC): http://www.ipcc.ch/

Several federal initiatives have been launched to improve the ability to understand, predict, and adapt to the challenges of climate change. The Secretary of the Interior signed Secretarial Order 3289 on February 22, 2010, establishing a Department-wide, scientific-based approach to increase understanding of climate change and to coordinate an effective response to impacts on managed resources. The order reiterated the importance of analyzing potential climate change impacts when undertaking long-range planning issues, and also established several initiatives including the development of eight Regional Climate Science Centers. Regional Climate Science Centers would provide scientific information and tools that land and resource managers can apply to monitor and adapt to climate changes at regional and local scales (DOI 2010). The North Central Climate Science Center, which will incorporate the Planning Area, has a target establishment date of 2011.

Given the broad spatial influence of climate change which requires response at the landscape-level, the DOI also established Landscape Conservation Cooperatives which are management-science partnerships that help to inform management actions addressing climate change across landscapes. These Cooperatives are formed and directed by land, water, wildlife and cultural resource managers and interested public and private organizations, designed to increase the scope of climate change response beyond federal lands.

Rapid ecoregional assessments are one of the tools the BLM uses to monitor and respond to the effects of climate change. Ecoregional assessments are geospatial landscape evaluations that are designed to identify areas of high ecological value within an ecoregion that may warrant conservation, adaptation, or restoration. These assessments can help to identify resources that are being impacted by climate change and provide information to facilitate the subsequent development of an ecoregional conservation strategy for plants, wildlife and fish communities on public lands. Ecoregional assessments can identify areas, species, and ecological features and services that are sensitive to ecosystem instability and changes in climatic conditions. One of the objectives of the BLM rapid ecoregional assessments is to provide guidance for adaptation and mitigation planning in response to climate change.

In addition to efforts being undertaken to better respond and adapt to climate change, other federal initiatives are being implemented to mitigate climate change. The Carbon Storage Project was implemented to develop carbon sequestration methodologies for geological (i.e., underground) and biological (e.g., forests and rangelands) carbon storage. The project is a collaboration of federal agency and external stakeholders to enhance carbon storage in geologic formations and in plants and soils in an environmentally responsible manner. The Carbon Footprint Project is a project to develop a unified GHG emission reduction program for the DOI, including setting a baseline and reduction goal for the Department's GHG emissions and energy use. More information about DOI's efforts to respond to climate change is available at: www.doi.gov/archive/climatechange/.