CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

This chapter provides a description of the existing biological, physical, and socioeconomic characteristics, including human uses that could be affected by implementing the action alternatives as described in Chapter 2 for this resource management plan (RMP). Information from broad-scale assessments were used to help set the context for the planning area. The information and direction for the Bureau of Land Management (BLM) resources has been further broken into fine-scale assessments and information where possible. The public and agency scoping process raised specific aspects of each resource discussed in this section (e.g., weeds, fire, and off-highway vehicle [OHV] use). The level of information presented in this chapter is used to help assess potential effects of the action alternatives in Chapter 4.

Because acre figures and other numbers used are approximate projections, readers should not infer that they reflect exact measurements or precise calculations. Acreages were calculated using geographic information systems (GIS) technology and there may be slight variations in total acres between resources.

HOW TO READ THIS CHAPTER

This chapter is organized into four sections, including Resources, Resource Uses, Special Designations, and Social and Economic Conditions. These sections are further divided into resources or programs, which are also presented in Chapter 3.

Summer in Eastern Montana near Chalk Buttes.

For a description of the affected environment, see below or, for electronic drafts, click on the following link to take you to a specific section:

Air Resources and Climate, Areas of Critical Environmental Concern, Back Country Byways, Coal, Cultural Resources, Environmental Justice, Facilities, Fish and Wildlife, (Aquatics, Terrestrial, and Special Status Species), Forestry and Woodland Products, Geology, Geothermal, Hazardous Materials and Waste, Invasive Species (Vegetation), Lands and Realty, Lands with Wilderness Characteristics, Livestock Grazing, Locatable Minerals, Mineral Materials, Minerals, Oil and Gas, Paleontological Resources, Recreation, Renewable Energy, Riparian and Wetland Areas, Social and Economic, Soils, Special Designation Areas, Special Recreation Management Areas, Special Status Species-Plants, Transportation, Travel Management and OHV, Vegetation, Visual Resources, Water Resources, Wilderness, Wild and Scenic Rivers, and Wildland Fire Management and Ecology.

RESOURCES

This section contains a description of the existing biological and physical resources of the Miles City Field Office (MCFO) planning area and follows the order of topics addressed in Chapter 2 as follows:

- Air Resources and Climate,
- Soil,
- Water Resources,
- Vegetation,
    - Special Status Species – Plants,
    - Riparian and Wetland Areas,
    - Invasive Species,
- Fish and Wildlife
    - Aquatics,
    - Terrestrial,
    - Special Status Species – Fish and Wildlife,
- Wildland Fire Ecology and Management,
- Cultural Resources,
- Paleontological Resources,
- Visual Resources, and
- Lands with Wilderness Characteristics.

Winter on the Yellowstone River at Matthews Recreation Area north of Miles City.

AIR RESOURCES AND CLIMATE

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. Pollutant transport from specific source areas is affected by local topography and meteorology. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants and block the flow of pollutants toward certain areas. In general, local effects are superimposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

This section begins with a description of current climate and currently identified climate change trends. Following this discussion, air resources will be described in terms of air quality, air quality related values (AQRV), specifically acid deposition and visibility, current emissions in the planning area, and smoke management.

CLIMATE

Climate is the combination of temperature, humidity, atmospheric pressure, wind, rainfall, sunshine, cloudiness, and other meteorological characteristics in a given region over a long period of time. Climate differs from weather, which is the present condition of these characteristics and their variations over shorter periods. Climate change involves long-term trends indicating a noticeable shift in climate.

Primary climate indicators that can be monitored include ambient air temperature, atmospheric pressure, wind, relative humidity, precipitation amounts and timing, annual snowpack levels, streamflow volume and timing, and solar radiation.

Current Conditions

The planning area is within the Great Plains-Palouse Dry Steppe Province (Eco-region 331) of the Temperate Steppe Division (Division 330) in the Dry Domain (Bailey 1995). The planning area is in the rain shadow of the Rocky Mountains and is characterized as a semi-arid continental regime of the Great Plains grasslands.

Average annual temperature is about 45 degrees Fahrenheit (°F). Winters are cold and dry while the summers are warm to hot. The frost-free season ranges from 100 days per year in the north to more than 200 days further east. Maximum rainfall occurs in summer, with about 10 inches of precipitation per year. Because evaporation exceeds precipitation, the total supply of moisture is low.

Specific climate data from seven Cooperative Observer Program (COOP) weather stations (Baker, Broadus, Glendive, Jordan, Lame Deer, Miles City, and Sidney) within the planning area are shown in Tables 1 through 7 in the *Air Resources and Climate Appendix*. Data for each site spans 50 or more years. The average annual temperature is approximately 45 °F at most of the sites. Winters are cold and dry, with the lowest average minimum monthly temperature occurring in January and varying from 1°F in Sidney to 9.4°F in Baker. Summers are warm to hot with average maximum monthly temperatures occurring in July and varying from 84.9°F in Sidney to 90.7°F in Baker. The frost-free season ranges from 100 days per year in the north to more than 200 days further east.

Mean annual precipitation at locations throughout the planning area varies from 11.7 to approximately 15.0 inches (Tables 1 through 7 in the *Air Resources and Climate Appendix* and Figure 3-1). Maximum rainfall occurs in summer. Because evaporation exceeds precipitation, the total supply of moisture is low. Average total annual snowfall varies from 27.4 to 46.3 inches (Tables 1 through 7 in the *Air Resources and Climate Appendix*).

Based on hourly wind data from airport locations in Baker, Glendive, Jordan, Miles City, and Sidney (Table 8 in the *Air Resources and Climate Appendix*), average annual wind speeds varied over the region from 8.6 to 11.1 miles per hour (mph), while the average monthly wind speeds varied from approximately 7.7 to 12.7 mph. March, April, and May are typically the windiest months of the year. Wind roses shown in Figures 1 through 5 of the *Air Resources and Climate Appendix* illustrate wind direction and wind speed at five locations within the planning area. Each wind rose consists of 16 arms whose radial positions indicate the frequency of wind blowing from the indicated direction. Longer arms indicate that the wind more frequently originates from the illustrated direction. Colored bands within each arm indicate the proportion of time that the wind blows with a given speed.

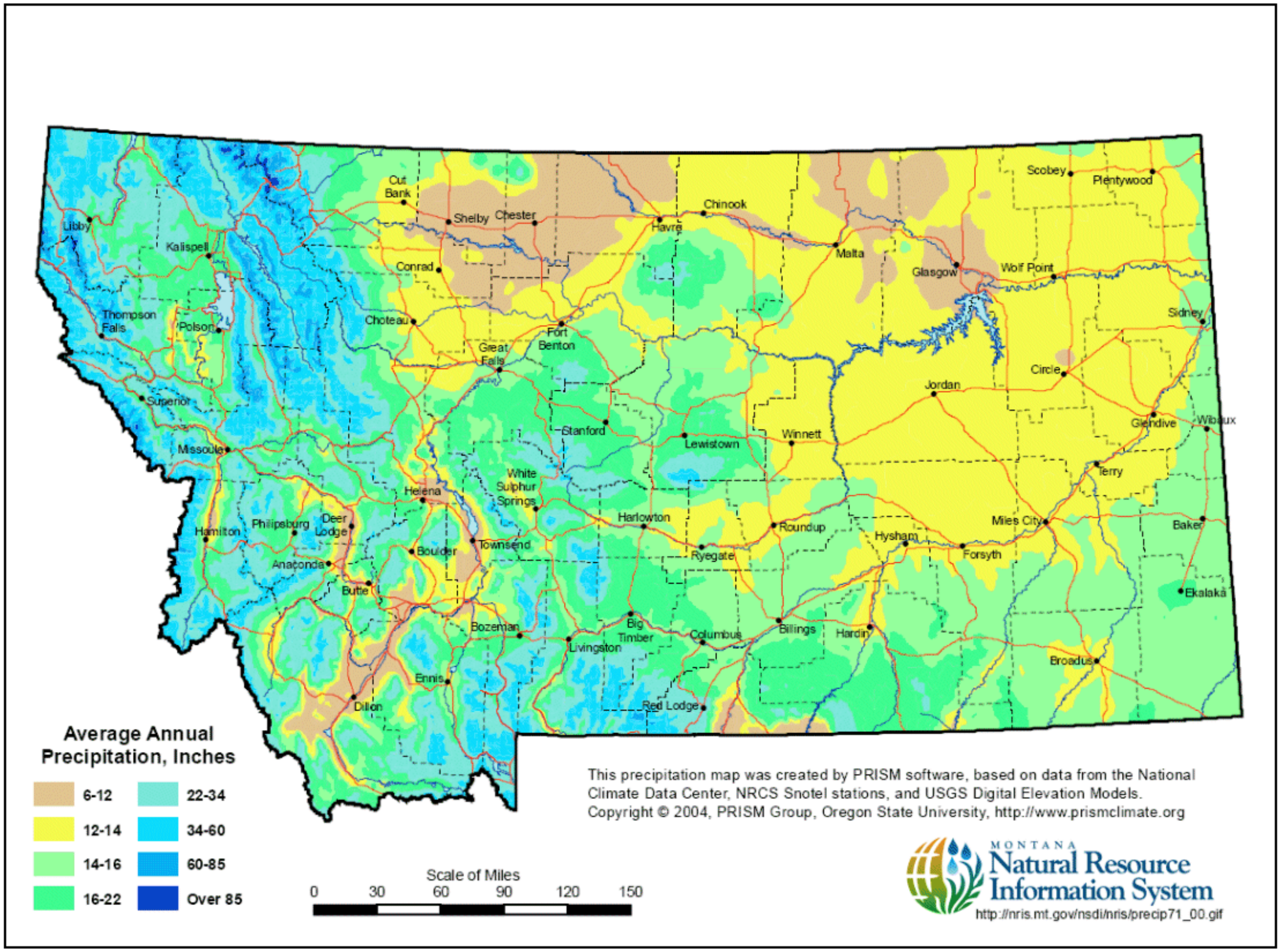
Trends

Climate trends are discussed in the *Climate Change* section.

CLIMATE CHANGE

Climate change includes two separate issues: cause and effect. Climate change is caused by physical and chemical changes in the environment, such as increased atmospheric concentrations of greenhouse gases (GHGs) and changes in albedo (surface reflectivity). The effects of climate change are widespread and include changes in climate indicators, such as temperature and precipitation, as well as effects on many natural resources, including air quality, water quality, flora, fauna, and many other resources on local, regional, national, and global scales. Climate change also affects human health and economic resources.

FIGURE 3-1.
AVERAGE ANNUAL PRECIPITATION IN MONTANA (1971 TO 2000)



Source: MNRIS 2004

Primary climate change indicators that can be monitored are similar to those for climate, with some additions. Atmospheric concentrations of GHGs, surface albedo, and ocean temperatures are also important climate change indicators, although these additional indicators are not monitored in the planning area.

Current Conditions

The Intergovernmental Panel on Climate Change (IPCC) concluded that "warming of the climate system is unequivocal" (IPCC 2007b, p. 5) and "most of the observed increase in global average temperatures since the mid-20th century is very *likely* due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007b, p. 10). Chapter 9 of *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* addressed the causes of climate change. Some of the conclusions included:

- human-induced warming of the climate system is widespread,
- "it is *likely*" that there has been a substantial anthropogenic contribution to surface temperature increases since the mid-20th century, and
- surface temperature extremes have "*likely*" been affected by anthropogenic forcing.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty because they are based on well-known physical laws and documented trends.

The temperature of the planet's atmosphere is determined by the amount of solar radiation absorbed by the earth and its atmosphere. GHGs (primarily carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]) increase the earth's temperature by reducing the amount of solar energy that re-radiates back into space. In other words, more heat is trapped in the earth's atmosphere when atmospheric concentrations of GHGs are greater. While GHGs have occurred naturally for millennia and are necessary for life on earth, increased atmospheric concentrations of GHGs, as well as land use changes, are contributing to an increase in average global temperature (IPCC 2007b). This warming, which is associated with climatic variability that exceeds the historic norm, is known as climate change. Extensive explanations of climate change causes and effects are provided in the *Climate Change Supplementary Information Report: Montana, North Dakota, and South Dakota Bureau of Land Management*, *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, *Climate Change Indicators in the United States*, and *Global Climate Change Impacts in the United States*.

Table 3-1 summarizes annual GHG emissions for Montana, the United States, and the world. Annual emissions of GHGs are usually quantified in units of metric tons (mt). An mt is equivalent to approximately 2,005 pounds (1.102 short tons). The combined effect of emissions of multiple GHGs is reported in terms of carbon dioxide equivalent (CO_2e), which is calculated by multiplying emissions by a global warming potential number that takes into account each gas's atmospheric longevity and its heat-trapping capability. The global warming potential of carbon dioxide is set at 1. The United States Environmental Protection Agency (USEPA) determined other GHGs' relative climate change potentials over a 100-year period. In USEPA regulations, global warming potentials for methane and nitrous oxide are 21 and 310, respectively. Other organizations, such as the IPCC, have set slightly different global warming potentials.

Planning area GHG emission sources include combustion equipment such as heaters and engines, oil and gas development and production, coal mining, fire events, motorized vehicle use (construction equipment, cars and trucks, and OHVs), livestock grazing, facilities development, and exhaust and fugitive emissions from other equipment. 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), changes in vegetation, and soil erosion (which can reduce snow's solar reflectivity and contribute to faster snowmelt). Emission controls on some sources can reduce GHG emissions.

TABLE 3-1.
ESTIMATED ANNUAL GREENHOUSE GAS EMISSIONS

Entity	Data Year	CO_2e Emissions (10^6 mt)
Montana	2007	50.4
United States	2009	6,633
Global	2004	49,000

Emissions exclude GHG emissions and sequestration due to land use and land use changes.

Global atmospheric concentrations of GHGs are determined by the quantity of GHGs emitted to and removed from the atmosphere. Global concentrations of carbon dioxide, methane, and nitrous oxide in 2009 were 387 parts per million (ppm), 1,744 parts per billion (ppb), and 323 ppb, respectively (USEPA 2011c). Atmospheric concentrations of carbon dioxide can be reduced by carbon storage in forests, woodlands, and rangelands, as well as in underground carbon sequestration projects. Vegetation management can provide a source of carbon dioxide (e.g., prescribed burns) or it can provide a sink of carbon dioxide through vegetation growth. The net storage or loss of carbon on rangelands and grasslands in the planning area is generally small and difficult to estimate or measure. Most soils within the planning area contain relatively little organic matter compared to forest soils (forests and woodlands compose approximately 7 percent of the total acres on public lands in the planning area).

Trends

Climate change trends include two types of trends: historic and predicted. Historic trends describe climate changes that have already been observed. Predicted climate change indicates modeled future changes based on assumptions of future global GHG emission and resulting environmental effects. Climate change will continue into the future even if GHG emissions remain at current levels or decrease. Long lag times are associated with the massive thermal energy stored in oceans, which can take decades, or even centuries, to adjust to climate changes (USEPA 2010i). In addition, the long lifetimes of many GHGs contribute to committed climate change. For example, carbon dioxide typically remains in the atmosphere for 50 to 200 years, depending on how long it takes carbon dioxide molecules to be absorbed by plants, land, or the ocean. Nitrous oxide is also long lived; it remains in the atmosphere for approximately 120 years. In contrast, methane has a shorter lifetime and remains in the atmosphere for approximately 12 years (USEPA 2010i). Additional types of GHGs also contribute to climate change, but their impact is substantially less because of their relatively small concentrations in the atmosphere.

Temperature and Precipitation

Historical global mean surface temperatures have increased nearly 1.3°F from 1906 through 2008 (GISS and Sato 2010). Northern latitudes (above 23.6 through 90.0° N) have exhibited greater temperature increases of nearly 2.1°F since 1900, with nearly a 1.8 °F increase since 1970 alone (GISS and Sato 2010). In the planning area, data from 1941 through 2005 indicate a long-term temperature increase between 0.40 to 0.80°F per decade since 1976 (Figure 3-2). Over a recent 32-year period, planning area observed winter temperatures increased up to 7°F (see Figure 7 in the *Air Resources and Climate Appendix)* (Karl, Melillo, and Peterson 2009). With regard to precipitation, data from 1931 through 2005 indicated little change in total annual precipitation in eastern Montana since 1976. However, the timing of precipitation may have changed.

Predictions of future temperature changes compared to a 1961 to 1979 baseline indicate that temperatures in the planning area may increase 2 to 3°F by 2010 to 2029 (Figure 3-3). Temperatures are predicted to continue increasing through the century by 3 to 5°F by the mid-21^{st} century and increase by 5 to 9°F by the end of the century, compared to the 1961 to 1979 baseline (see Figure 6 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). The lower end of these ranges is based on a lower future GHG emission scenario, while the upper end of the ranges is based on a higher GHG emission scenario. Along with generally increasing temperatures, many more days are predicted to have maximum temperatures greater than 100°F (see Figure 8 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 2.5 to 10.4°F above 1990 levels (IPCC 2001). The National Academy of Sciences confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions (NAS 2008). Computer model predictions indicate that increases in temperature will not be equally distributed but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Rising temperatures would increase water vapor in the atmosphere and reduce soil moisture, increasing generalized drought conditions while at the same time enhancing heavy storm events.

Prediction of future precipitation changes from the recent past to 2080 to 2099 indicate that precipitation in the planning area will increase 15 to 20 percent in winter and spring and decrease no more than 5 percent in summer. During fall, precipitation in the northern part of the planning area will increase by up to 5 percent while the southern portion of the planning will experience a 0- to 5-percent decrease (see Figure 9 in the *Air Resources and Climate Appendix*) (Karl et al. 2009).

In addition to temperature and total precipitation changes, predicted climate changes include changes in precipitation timing by season and an increase in extreme rainfall events and other extreme weather events. Warming temperatures, melting glaciers, and thermal expansion within the seawater will cause ocean levels to rise. These changes will affect a broad array of ecosystems and affect food supplies and human health.

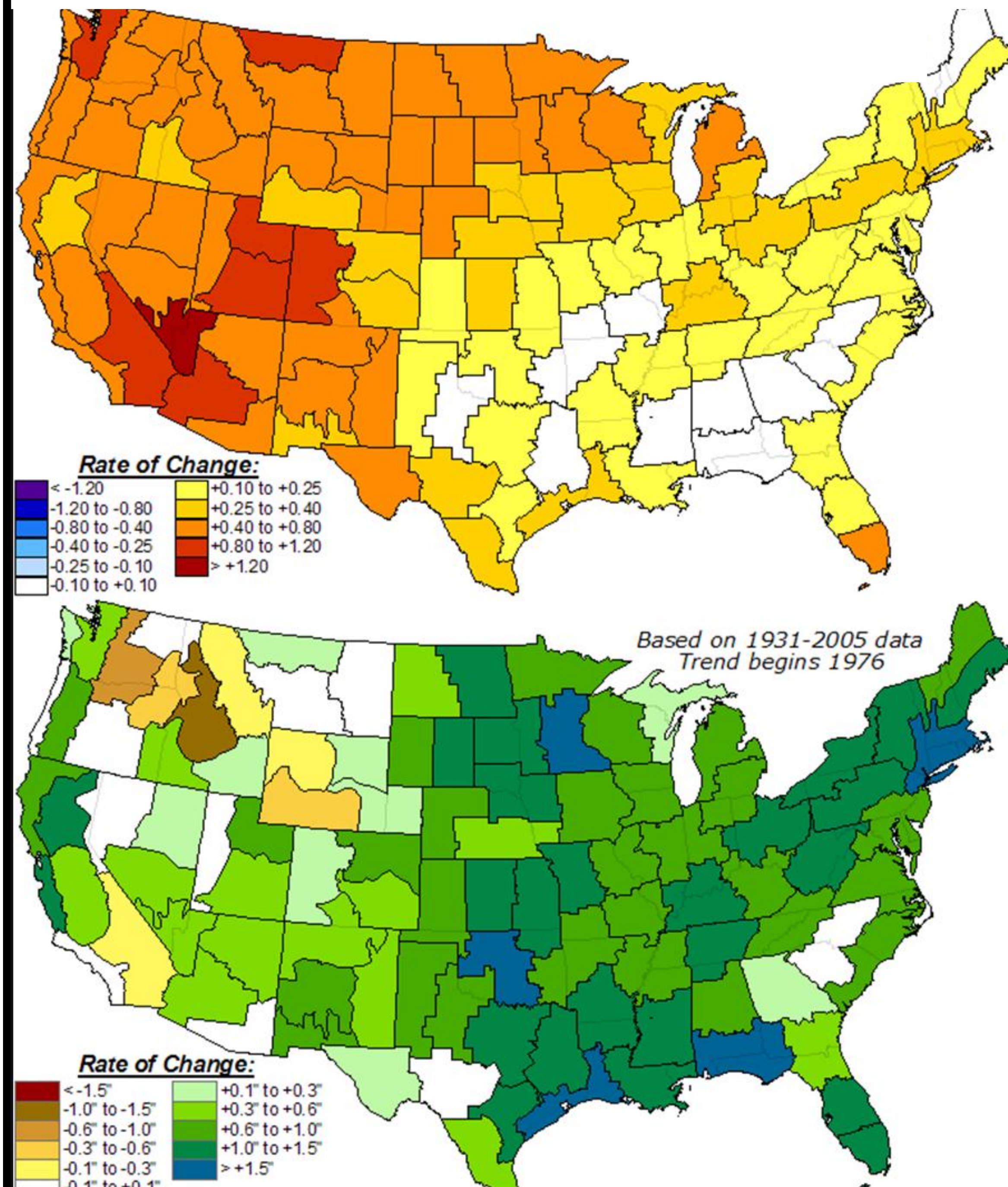
Climate Change Impacts on Resources

Climate change affects nearly all resources at local, regional, and global levels. The impacts of climate change are so widespread that they cannot all be described in this RMP. To illustrate the effects of global temperature change, Figure 3-4 provides broad examples of climate change impacts. As global temperatures increase, impacts to resources become more significant.

Temperature and precipitation changes could directly affect air quality. Air quality would be improved if increased precipitation reduces wind-blown dust but degraded if dry periods caused increased particulate emissions. Ground-level ozone (O_3) may also be affected. High temperatures are a contributing factor in ground-level ozone formation, which is highly dependent on nitrogen oxides (NO_x) and volatile organic compound (VOC) concentrations. End-of-century ozone concentrations in the planning area are predicted to decrease during the months of June through August based on a lower GHG emission scenario and increase based on a higher emission scenario (Figure 10 of the *Air Resources and Climate Appendix*) (Karl et al. 2009).

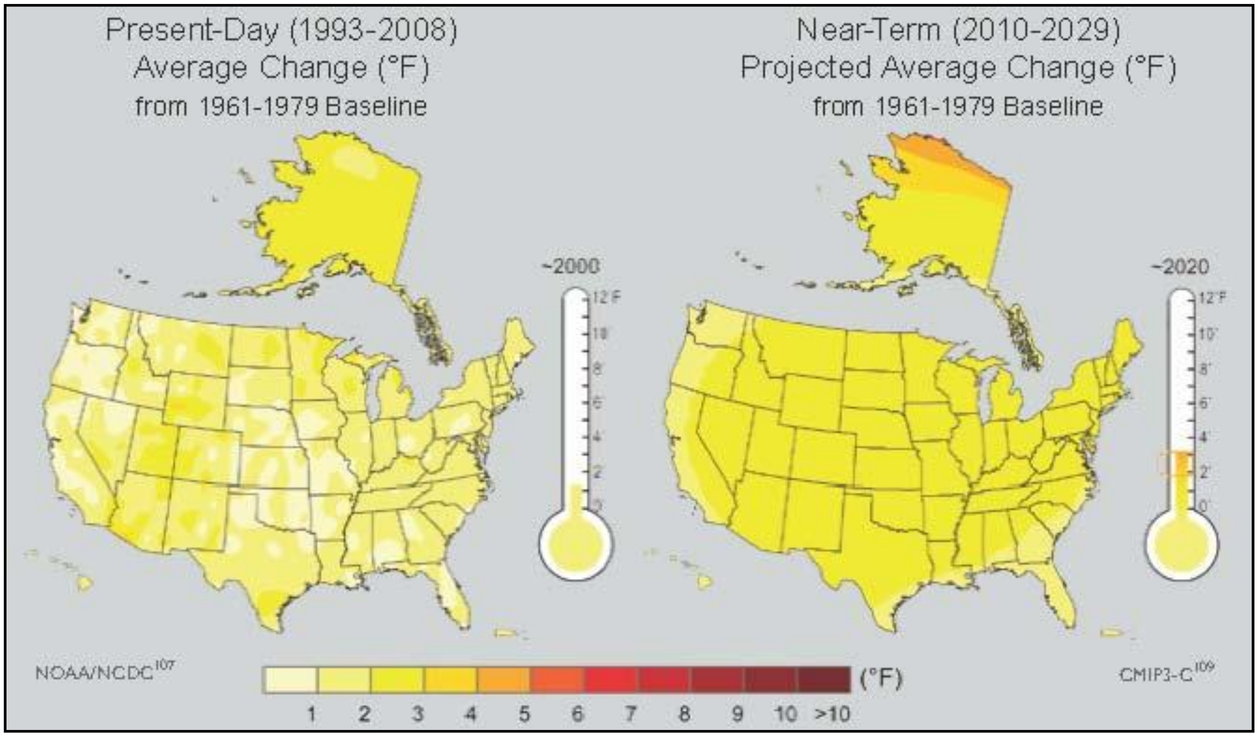
Climate change will affect water quality in the planning area. Increasing temperatures in the planning area are likely to contribute to increased evaporation, drought frequencies, and declining water quantity. The warming of lakes and rivers will adversely affect the thermal structure and water quality 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 United States Geological Survey (USGS) notes that mountain ecosystems in the western United States are particularly sensitive to climate change, particularly in the higher elevations (where much of the snowpack occurs) that have experienced three times the global average temperature increase over the past century (USGS 2010a). 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 (Karl et al. 2009). Rapid spring snowmelt resulting from sudden and unseasonal temperature increases can also lead to greater erosive events and unstable soil conditions.

FIGURE 3-2.
RATE OF LONG-TERM TREND TEMPERATURE CHANGE AND PRECIPITATION CHANGE



Source: NOAA 2010a

FIGURE 3-3.
NEAR-TERM PREDICTED TEMPERATURE INCREASES.

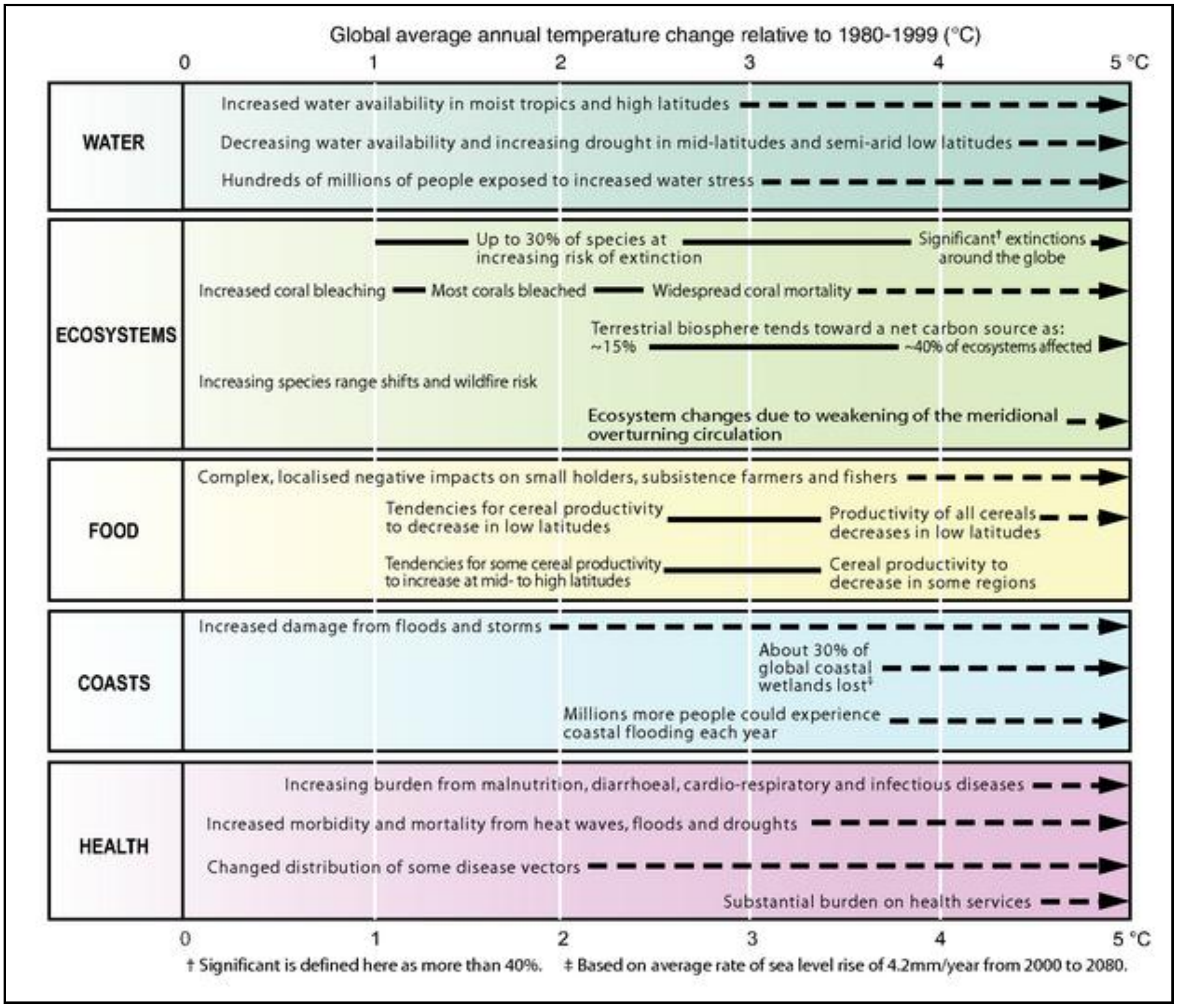


Source: Karl et al. 2009

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 (Karl et al. 2009). Studies have shown that earlier snowmelts can lead to a longer dry season, which increases the incidence of catastrophic fire (Westerling, Hidalgo, Cayan, and Swetnam 2006b). Together with historic changes in land use, climate change is anticipated to increase the occurrence of wildfire throughout the western United States. Predicted climate change impacts to wildfires show large increases in the annual average acreage burned. Based on modeling that assumed a 1°Celsius (1.8°F) increase in global average temperature, a 393 percent increase in acreage burned in wildfires is predicted in the planning area (see Figure 11 in the *Air Resources and Climate Appendix*) (Karl et al. 2009). Air quality, ecosystem, and economic impacts from wildfires are extensive. Wildfires also release large quantities of carbon dioxide that would increase atmospheric GHG concentrations.

There is evidence that recent warming is affecting 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 elevations, as the climate of these species' traditional habitats change. As future changes in climate are predicted to be even greater past changes, there will likely be even larger range shifts in the coming decades (Lawler et al. 2009). Warming temperatures are also linked to earlier vegetation growth 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, and range changes and earlier fish migrations in rivers have been observed (IPCC 2007b). Climate change is likely to combine with other human-induced stressors to further increase the vulnerability of ecosystems to additional pests, additional 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 sage-grouse, which are already stressed by declining habitat, increased development, and other factors, could experience additional pressures because of climate change.

FIGURE 3-4.
EXAMPLES OF RESOURCE IMPACTS FROM CLIMATE CHANGE.



Source: IPCC 2007b

High-frequency flooding events, erosion, wildfires, and hotter temperatures 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 promote discoveries of new cultural and paleontological localities.

Climate change also poses challenges for many resource uses on BLM-administered lands. 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 resulting from climate change may influence hunting and fishing activities, and early snowmelt may affect winter and water-based recreational activities. Drought and resulting stress on vegetation is likely to 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.

National Action to Reduce GHGs

United States GHG emissions are expected to decline as a result of the USEPA's listing of GHGs as a regulated air pollutant and the implementation of several recent GHG regulatory programs. Facilities with large emissions of GHGs must report these emissions to the USEPA, and new facilities with large expected GHG emissions must obtain air quality permits and potentially control GHG emissions.

Within the United States Department of the Interior (USDI), several 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 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. 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 USDI also established Landscape Conservation Cooperatives, which are management-science partnerships that help to inform management actions addressing climate change across landscapes. These Cooperatives, which are formed and directed by land, water, wildlife, and cultural resource managers and interested public and private organizations, are 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 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 affected 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 changes in climatic conditions and areas, species, and ecological features and services that are sensitive to ecosystem instability. One of the objectives of the BLM rapid ecoregional assessment is to provide guidance for adaptation and mitigation planning in response to climate change.

In addition to efforts 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 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 USDI, including setting a baseline and reduction goal for the Department's GHG emissions and energy use. More information about the USDI's efforts to respond to climate change is available at www.doi.gov/archive/climatechange/.

AIR QUALITY

Indicators

Air quality indicators include air pollutant concentrations, which indicate the quality of the air humans breathe. AQRVs include other air resource characteristics such as light transmission (i.e., visibility) and acidic deposition. This RMP addresses air quality within the study area, which extends beyond the planning area and includes nearby areas in which air quality could potentially be affected by activities within the planning area. In some cases, data sources used to describe air resource characteristics in the planning area are located outside of the planning area.

Air pollutant concentration monitoring networks in Montana include the State and Local Air Monitoring Stations (SLAMS), Tribal monitoring networks, and the Clean Air Status and Trends Network (CASTNet). SLAMS are usually located in urban areas and measure criteria pollutants. The Montana Department of Environmental Quality (MDEQ) operates the SLAMS network to determine compliance with regulatory concentration standards. CASTNet stations are located in remote areas and measure concentrations of compounds of interest to ecosystem health. Air pollutant concentrations are usually reported on a volume basis as ppm or ppb for gaseous substances and on a mass basis as micrograms per cubic meter ($\mu g/m^3$) for solid substances such as particulate.

Monitors that provide information on AQRVs include the National Acid Deposition Program (NADP) network and the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. Table 3-2 provides a list of monitoring stations in or near the planning area.

Current Conditions

Criteria Air Pollutants

Criteria air pollutants are those for which national health-based concentration standards have been established under the National Ambient Air Quality Standards (NAAQS) program. Criteria air pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone, particulate matter with a diameter less than or equal to 10 microns (PM_{10}), fine particulate matter (diameter less than or equal to 2.5 microns) ($PM_{2.5}$), and sulfur dioxide (SO_2). Criteria air pollutant concentrations are compared to NAAQS (USEPA 2010c) and Montana Ambient Air Quality Standards (MAAQS) (Table 3-3). The NAAQS include both primary and secondary standards. Primary standards protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards protect public welfare by preventing damage to buildings, infrastructure, and vegetation.

The MDEQ performs regulatory monitoring of carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) to determine compliance with NAAQS and MAAQS. Areas that do not meet federal standards are known as nonattainment areas. The community of Lame Deer in Rosebud County is the only nonattainment area within the planning area. Particulate matter (PM_{10}) concentrations within Lame Deer exceed the particulate matter (PM_{10}) NAAQS. Montana counties containing nonattainment areas are shown in Map 50. The actual geographic extent of the Lame Deer nonattainment area is much smaller than the shaded county shown on the map. Similarly, the SO_2 nonattainment area in nearby Yellowstone County is limited to a small area in Laurel, Montana. Several other nonattainment areas are restricted to portions of the counties highlighted on the map. The entire state of Montana is considered to be attainment for carbon monoxide, nitrogen dioxide, and ozone, while small areas are nonattainment for fine particulate matter ($PM_{2.5}$), lead, and sulfur dioxide. A relatively large area in northwestern Montana is designated nonattainment for particulate matter (PM_{10}).

The sources and effects of each criteria pollutant are explained below. A summary of recent ambient air quality monitoring data is provided in Figure 3-5, which shows the percentage of the monitored concentration compared to the NAAQS. In addition to the monitor located in Sidney, Montana (Richland County), two monitors were established in the planning area during 2009 at Broadus (Powder River County) and Birney (Rosebud County).

Carbon Monoxide

Carbon monoxide can have significant effects on human health because it combines readily with hemoglobin and consequently reduces the amount of oxygen transported in the bloodstream. Effects on humans from exposure to high carbon monoxide concentrations can include slight headaches, nausea, or death.

Motor vehicles and other internal combustion engines are the dominant source of carbon monoxide emissions in most areas. High carbon monoxide levels develop primarily during winter when periods of light winds combine with ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Carbon monoxide is also created during refuse, agricultural, and wood-stove burning and through some industrial processes.

TABLE 3-2.
AIR QUALITY MONITORING STATIONS IN THE PLANNING AREA OR VICINITY

Monitoring System	Station Identifier	Pollutant or AQRV	Location	Lat	Long
SLAMS	30-111-0066	SO_2	Billings-Coburn Road	45.7883	-108.4595
	30-111-0085	CO, $PM_{2.5}$	Billings-St. Luke's	45.7822	-108.5115
	30-087-0001	NO, NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$	Birney-Tongue River	45.3662	-106.4894
	30-075-0001	NO, NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$	Broadus-Powder River	45.4401	-105.3702
	30-083-0001	NO, NO_2, NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Sidney-Oil Field	47.8034	-104.4856
CASTNET	THR422	O_3, SO_2, Deposition	Theodore Roosevelt National Park (North Dakota)	46.8947	-103.3778
NADP	MT00	Wet Deposition	Little Bighorn Battlefield National Monument	45.5686	-107.4375
	MT96	Wet Deposition	Poplar River	48.3100	-105.1000
	MT98	Wet Deposition	Havre-Northern Agricultural Research Center	48.4992	-109.7975
	ND00	Wet Deposition	Theodore Roosevelt National Park (North Dakota)	46.8951	-103.378
IMPROVE	FOPE1	Visibility	Fort Peck	48.308	-105.102
	MELA1	Visibility	Medicine Lake	48.4872	-104.476
	NOCH1	Visibility	Northern Cheyenne	45.6493	-106.557
	YELL2	Visibility	Yellowstone National Park (Wyoming)	44.5654	-110.4003
	NOAB1	Visibility	North Absaroka (Wyoming)	44.7448	-109.3816
	THRO1	Visibility	Theodore Roosevelt National Park (North Dakota)	44.8948	-103.3777
	ULBE1	Visibility	UL Bend	47.5823	-108.72

TABLE 3-3.
FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Federal NAAQS[1]			State MAAQS[2]
	Averaging Time	**Level**	**Standard Type**	**Level**
CO	8-hour	9 ppm[3]	Primary	9 ppm[12]
	1-hour	35 ppm[3]	Primary	23 ppm[12]
Fluoride in Forage	Monthly	N/A	N/A	50 µg/g
	Grazing Season	N/A	N/A	35 µg/g
Pb	3-month (rolling)	0.15 $\mu g/m^3$ [3, 5]	Primary, Secondary	N/A
	90-day	N/A	N/A	1.5 µg/g[5]
NO_2	Annual	0.053 ppm[5]	Primary, Secondary	0.05 ppm[13]
	1-hour	0.100 ppm[10]	Primary	0.30 ppm[12]
$PM_{2.5}$	Annual	15.0 $\mu g/m^3$ [3, 11]	Primary, Secondary	N/A
	24 hour	35 $\mu g/m^3$ [3, 7]	Primary, Secondary	N/A
PM_{10}	Annual	N/A	N/A	50 $\mu g/m^3$ [4]
	24-hour	150 $\mu g/m^3$ [3, 8]	Primary, Secondary	150 $\mu g/m^3$
Settleable Particulate	30-day	N/A	N/A	10 g/m^2
O_3	8-hour	0.075 ppm[6]	Primary, Secondary	0.10 ppm[12]
SO_2	Annual	0.030 ppm[5]	Primary	0.02 ppm[13]
	24-hour	0.14 ppm[3]	Primary	0.10 ppm[12]
	3-hour	0.5 ppm[3]	Secondary	N/A
	1-hour	0.075 ppm[9]	Primary	0.50 ppm[14]
Visibility	Annual	N/A	N/A	$3 \times 10^{-5}/m$ [15]

[1]NAAQS are codified in Title 40 of the Code of Federal Regulations (CFR), Part 50.
[2]MAAQS are codified in Title 17, Chapter 8, Subchapter 2 of the Ambient Air Quality in the Administrative Rules of Montana (ARM).
[3]Not to be exceeded more than once per calendar year.
[4]Not to be exceeded more than once per year on average over 3 years.
[5]Not to be exceeded.
[6]Not to be exceeded, based on the 3-year average of the fourth-highest daily maximum 8-hour concentrations per calendar year.
[7]Not to be exceeded based on the 98th percentile of 24-hour concentrations at each population-oriented monitor.
[8]Not to be exceeded more than once per calendar year, based on a 3-year average of maximum 24-hour values.
[9]Not to be exceeded, based on a 3-year average of the 99th percentile of the daily maximum concentrations.
[10]Not to be exceeded, based on a 3-year average of the 98th percentile of the daily maximum concentrations.
[11]Not to be exceeded, based on a 3-year average of the weighted annual mean from one or more community monitors.
[12]Not to be exceeded more than once over any 12 consecutive months.
[13]Arithmetic average not to be exceeded more than once over any 4 consecutive quarters.
[14]Not to be exceeded more than 18 times in any 12 consecutive months.
[15]This standard applies only in certain Class I areas (Table 3-5).

Carbon monoxide is not monitored within the planning area but is monitored west of the planning area in Billings, Montana. In 2011, the second highest 1-hour carbon monoxide concentration in Billings (Yellowstone County) was approximately 2.5 ppm, or approximately 7 percent of the corresponding primary NAAQS. This concentration was 11 percent of the more stringent 1-hour carbon monoxide MAAQS. The second highest 8-hour carbon monoxide concentration was 1.3 ppm during the same year, approximately 14 percent of the corresponding primary NAAQS and MAAQS.

Lead

The primary historical source of lead emissions has been certain types of industrial sources and lead in gasoline and diesel fuel. However, since lead in fuels has decreased substantially, the processing of metals containing trace amounts of lead is now the primary source of lead emissions. The highest levels of lead in air are generally found near lead smelters. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturing plants. The effects of lead exposure include brain and other nervous system damage; children exposed to lead are particularly at risk. Lead levels in the planning area are expected to be well below the NAAQS and MAAQS because the planning area does not contain large lead emissions sources.

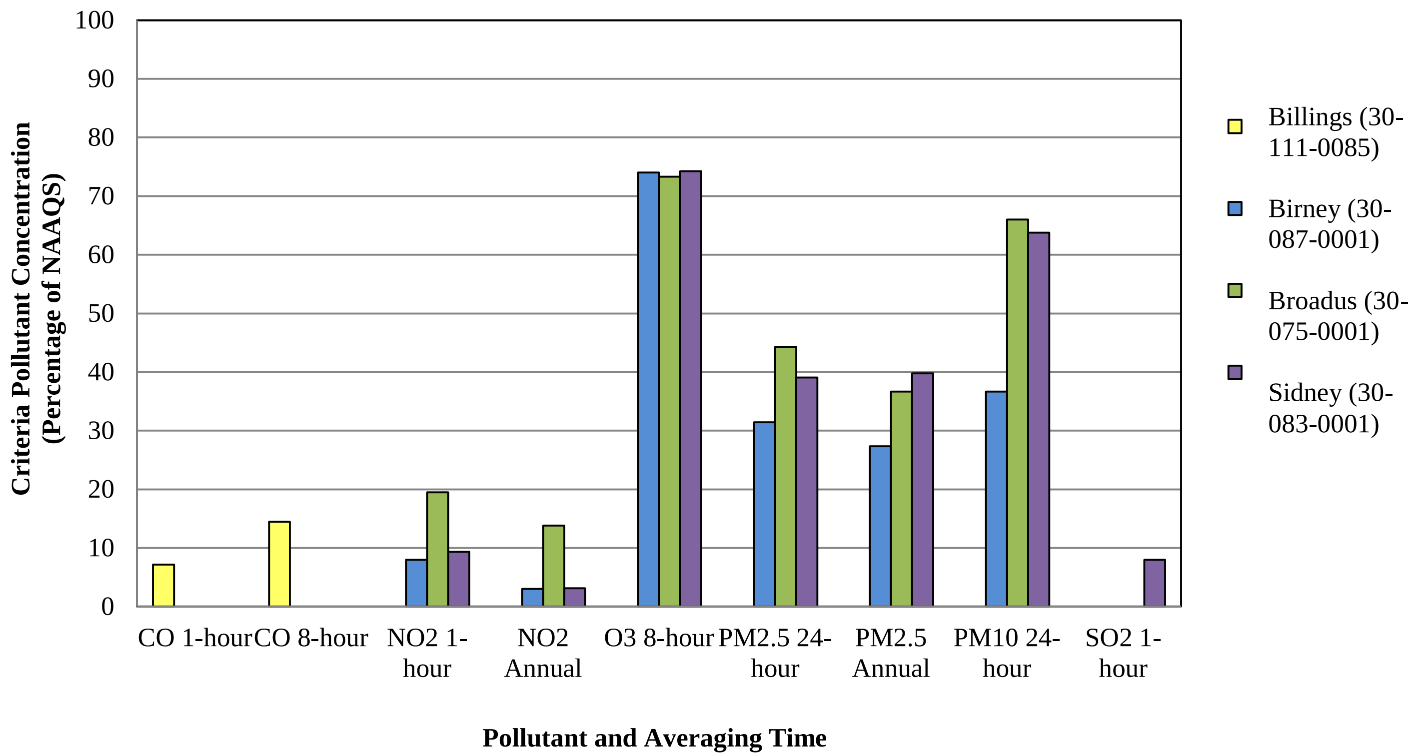
Nitrogen Dioxide

Oxides of nitrogen, including nitric oxide (NO) and nitrogen dioxide are formed when naturally occurring atmospheric nitrogen and oxygen are combusted with fuel in automobiles, power plants, industrial processes, and home and office heating. At high exposures, nitrogen dioxide causes respiratory system damage of various types, including bronchial damage. Its effects are exhibited by increased susceptibility to respiratory infection and changes in lung function. Within the atmosphere, nitrogen dioxide contributes to visibility impacts and may be visible as reddish-brown haze. Nitrogen dioxide (and other nitrogen oxide compounds) also forms nitric acid (HNO_3), a component of atmospheric deposition (e.g., acid rain).

Miller Creek prescribed fire in southeastern Montana

Scenic view of the Musselshell Breaks Wilderness Study Area

FIGURE 3-5.
BACKGROUND CONCENTRATIONS IN AND NEAR THE PLANNING AREA 2009 TO 2011



Billings: CO values are based on 2011 data. Birney and Broadus monitors: Values are based on 2010-2011 data, except for NO_2 values, which are based on 2011 data.
Sidney monitor: Annual NO_2 and 1-hour SO_2 values are based on calendar year 2011 data. Other Sidney values are 3-year averages based on 2009 to 2011 data.

The 98th percentile 1-hour nitrogen dioxide concentrations at Birney and Broadus were 8 and 20 percent, respectively, of the NAAQS from 2010 to 2011. Because full calendar year 2009 data were not available, 3-year averages were not calculated. The Sidney 2009 to 2011 3-year average of the 98^{th} percentiles was 9 percent of the NAAQS and 3 percent of the MAAQS. During 2011, annual average nitrogen dioxide concentrations were 3 to 14 percent of the NAAQS at the three sites.

Ozone

Ozone is not emitted directly into the atmosphere. Instead, it is formed by photochemical reactions of precursor air pollutants, including VOCs and nitrogen oxides. These precursors are emitted by mobile sources, stationary combustion equipment, and other industrial sources. Ozone is produced year-round, but urban ozone concentrations are generally greatest during the summer months, when there is greater sunlight and increased air temperatures. Elevated ozone concentrations may also occur during winter in snow-covered rural areas.

Ozone is a severe eye, nose, and throat irritant. A potent oxidant, it increases susceptibility to respiratory infections and may cause substantial damage to vegetation (leaf discoloration and cell damage) and other materials (attacking synthetic rubber, textiles, paints, and other substances).

The 2009 to 2011 3-year average of the fourth highest daily maximum 8-hour ozone concentration at the Sidney monitor was 0.056 ppm, which is 74 percent of the NAAQS and MAAQS. From 2010 to 2011, average fourth-highest daily maximum 8-hour concentrations were 0.056 ppm at Birney and 0.055 ppm at Broadus.

Particulate Matter

Particulate matter includes PM_{10} (inhalable particles and aerosols less than or equal to 10 microns in diameter) and $PM_{2.5}$ (fine particles and aerosols less than or equal to 2.5 microns in diameter). Particulate matter (PM_{10}) impacts include health effects (because PM_{10} is small enough to reach the lungs when inhaled), deposition on plants and surfaces (including soiling of snow, which can contribute to climate change), localized reductions in visibility, and potential corrosion. Particulate matter (PM_{10}) emissions are generated by a variety of sources, including agricultural activities, industrial emissions, and road dust re-suspended by vehicle traffic. Within the planning area, primary sources of particulate matter (PM_{10}) include smoke from wildland fire, residential wood burning, street sand, physically disturbed soils, and dust from unpaved roads.

Fine particulate matter (smaller-sized $PM_{2.5}$) poses greater health concerns than particulate matter (PM_{10}) because fine particulate matter can pass through the nose and throat and become trapped deep in the lungs. Fine particulate also contributes to reduced visibility in nationally important areas such as national parks. Fine particulate matter ($PM_{2.5}$) emissions are primarily generated by internal combustion diesel engines, soils with high silt and clay content, and secondary aerosols formed by chemical reactions in the atmosphere.

The 2009 to 2011 3-year average second highest 24-hour particulate matter (PM_{10}) concentration was 96 $\mu g/m^3$ or 64 percent of the corresponding primary and secondary NAAQS and MAAQS at the Sidney monitor. During 2011, second highest concentrations were 55 ppm and 99 ppm at Birney and Broadus, respectively, which was equivalent to 37 and 66 percent of the NAAQS. The 3-year average 98th percentile 24-hour fine particulate matter ($PM_{2.5}$) concentration at Sidney was 14 $\mu g/m^3$, which was 40 percent of the corresponding primary and secondary NAAQS. The 3-year average weighted mean fine particulate matter ($PM_{2.5}$) annual concentrations at Sidney were 6.0 $\mu g/m^3$, or approximately 40 percent of the corresponding primary and secondary NAAQS.

Sulfur Dioxide

Sulfur dioxide is a colorless gas with a pungent odor. Prolonged exposure to high levels of sulfur dioxide can lead to respiratory failure, and sulfur dioxide plays an important role in the aggravation of chronic respiratory illnesses such as asthma. Sulfur dioxide is emitted primarily from stationary sources that burn fossil fuels (i.e., coal and oil) containing trace amounts of elemental sulfur. Although other sources of sulfur dioxide include metal smelters and petroleum refineries, sulfur dioxide is also emitted on occasion from natural sources such as volcanoes. In the atmosphere, sulfur dioxide converts to sulfuric acid, a component of atmospheric deposition (acid rain), and forms secondary aerosols, subsequently contributing to visibility impacts in nationally important areas.

The 2011 single-year average 99th percentile 1-hour sulfur dioxide concentration was 6 ppb in Sidney. This concentration was 8 percent of the primary NAAQS and 1 percent of the MAAQS. Sulfur dioxide concentrations are not measured at the Birney or Broadus monitors.

Volatile Organic Compounds

VOCs include a variety of chemicals, some of which may have adverse health effects. Concentrations of many VOCs are consistently higher indoors than outdoors. VOCs are emitted from thousands of products, including paints, cleaning supplies, pesticides, building materials, office equipment, glues, and permanent markers (USEPA 2010i). VOCs are not subject to a NAAQS. However, since they react with nitrogen oxides to form ground-level ozone, VOCs are a precursor to ozone and regulated by the USEPA.

Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are pollutants that are known or suspected to cause cancer or other serious health problems, including chronic respiratory disease, reproductive disorders, or birth defects. Of the 187 regulated HAPs, several are commonly emitted from planning area engines and other sources. Currently emitted HAPs include formaldehyde, benzene, toluene, ethyl benzene, xylenes, and hexane (i.e., n-hexane). Potential concentrations of HAPs are compared to health-based thresholds to estimate the risk of health effects.

Mercury is a HAP and its emissions are largely associated with large coal-burning facilities, such as electrical utilities. Ambient concentrations of mercury are not monitored within the planning area. During 2008, monitors in or near Montana indicated that ambient average mercury concentrations were 6.4 nanograms per liter (ng/L) in Glacier National Park, 8.8 ng/L in Yellowstone National Park, and 11.4 ng/L in the Lostwood Wilderness in North Dakota (see Figure 23 in the *Air Resources and Climate Appendix)*.

Other Pollutants

Other air pollutants of interest include nitrogen and sulfur compounds, which contribute to acid deposition and regional haze. Nitrogen compounds include particulate nitrate (NO_3^-), nitric acid, and ammonium (NH_4^+), and sulfur compounds include particulate sulfate (SO_4^{-2}) and sulfur dioxide. Concentrations of nitric acid, sulfur dioxide, ammonium, particulate nitrate, and sulfate are low in Montana in relation to concentrations across the United States (see Figures 21 and 22 in the *Air Resources and Climate Appendix)*.

Criteria Pollutant Emissions

Current air quality reflects the impacts of emissions of existing sources of air pollution. Table 3-4 provides an estimate of recent emissions within the MCFO based on a compilation of available emission inventory sources. Emissions of HAPs and GHGs are not included in Table 3-4 because these emissions have not been reported to the MDEQ and the information is generally not available. Many facilities within the MCFO will begin reporting GHG emissions to the USEPA because of the recent implementation of a new federal air quality rule.

Trends

Carbon Monoxide

Carbon monoxide 1-hour and 8-hour concentrations monitored in Billings from 2009 to 2011 show no discernible trend.

TABLE 3-4.
ESTIMATE OF CURRENT MCFO STATIONARY AND OIL AND GAS INDUSTRIAL EMISSIONS IN TONS PER YEAR

Source Group	CO	NO_1	VOC	SO_2	PM_{10}	$PM_{2.5}$
2010 Oil and Gas Well Sources[1]	2,796.3	2,404.4	12,356.5	22.4	407.4	147.4
2009 MDEQ and other point sources[2]	3,822.2	20,150.7	392.3	1,8115.9	4,302.3	126.2
2008 Non-road sources[3]	19,273.0	14,768.9	2,910.9	339.3	960.5	925.4
2008 On-road sources[3]	36,259.9	3,609.6	2,406.0	14.4	127.8	97.9
Current Estimate of Emissions	**62,151.4**	**40,933.6**	**18,065.**	**18,492.0**	**5,798.0**	**1,296.9**

Source: URS 2011
Emission estimates are provided in short tons per year. Emissions are not available for HAPs and GHGs.
[1]This source group does not include gas compression engine emissions, which are included in the MDEQ emission inventory.
[2]The MDEQ emission inventory includes stationary (i.e., "point") sources. Mobile sources such as cars, trucks, and OHVs (including heavy construction equipment) are not included in the inventory.
[3]These data were derived from Western Regional Air Partnership emission inventories.

Lead

No data are available to determine the trend in lead concentrations. However, decreasing lead levels in gasoline and diesel fuel indicate a likely decrease in lead levels within the planning area.

Nitrogen Dioxide

Hourly nitrogen dioxide concentrations in Sidney remained relatively constant from 2009 to 2011. In contrast, concentrations monitored at the Birney and Broadus monitors decreased from 2010 to 2011. One-hour nitrogen dioxide 98th percentile concentrations decreased by approximately 38 percent at Broadus and 22 percent at Birney.

With regard to annually averaged nitrogen dioxide concentrations, Sidney data show a decreasing trend from 2009 to 2011. Based on 2010 to 2011 data, average concentrations decreased by 15 percent at Birney and increased by 6 percent at Broadus.

Ozone

Ozone concentrations based on fourth highest daily maximum 8-hour averages decreased by 10 percent from 2009 to 2011 at the Sidney monitor. Ozone concentrations also decreased at Birney and Broadus by 15 percent and 4 percent, respectively, from 2010 to 2011.

Particulate Matter

Particulate matter concentrations are affected by the weather, leading to substantial variability from year to year. Fine particulate matter ($PM_{2.5}$) 98th percentile 24-hour concentrations were variable in Sidney (2009 to 2011), stable in Birney (2010 to 2011), and increased by approximately 21 percent in Broadus (2010 to 2011). With regard to particulate matter (PM_{10}), second maximum 24-hour concentrations were variable in Sidney from 2009 through 2011, and increased from 2010 to 2011 by approximately 16 percent and 54 percent in Birney and Broadus, respectively.

Sulfur Dioxide

Because the Sidney sulfur dioxide monitoris new (2011), sulfur dioxide concentration trends are not available.

Volatile Organic Compounds

VOC concentration trend data are not available.

Hazardous Air Pollutants

HAP concentration trend data are not available.

Other Pollutants

From 1999 through 2008, concentrations of nitrogen compounds, including particulate nitrate, nitric acid, and ammonium have been variable at Theodore Roosevelt National Park (see Figure 22 in the *Air Resources and Climate Appendix)*. Mean annual concentrations of sulfur compounds (sulfate and sulfur dioxide) show a decreasing tend between 2001 and 2008 (see Figure 23 in the *Air Resources and Climate Appendix)*.

AIR QUALITY RELATED VALUES

AQRVs include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified for a particular area. Air pollution can impact AQRVs through ambient exposure to elevated atmospheric concentrations, such as ozone effects to vegetation, through impairment of scenic views by pollution particles in the atmosphere, and through deposition of air pollutants, such as sulfur and nitrogen compounds, on the earth's surface through precipitation or dry deposition. AQRVs on federal lands are identified and managed within the respective jurisdictions of several land management agencies, including the United States Forest Service (USFS), National Park Service (NPS), United States Fish and Wildlife Service (USFWS), and BLM. Class I areas are afforded specific AQRV protection under the Clean Air Act. Under NEPA, Class II areas may be analyzed to assess AQRV impacts if they are identified as sensitive Class II areas.

Table 3-5 lists Class I and potential sensitive Class II areas in or near the planning area. Class I areas in or adjacent to the planning area include the Fort Peck IR, Northern Cheyenne IR, Medicine Lake Wilderness, and UL Bend Wilderness. Additional Class I areas located near the planning area are also shown in Table 3-5. Potential sensitive Class II areas within the planning area include the large Charles M Russell National Wildlife Refuge (NWR) and several other NWRs. Sensitive Class II areas will be identified in the Final Proposed RMP/EIS, based on information provided by the relevant agencies.

Current Conditions

Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems. Deposition is reported as the mass of material deposited on an area in a given period (e.g., kilogram per hectare per year [kg/ha-yr]). Wet deposition refers to air pollutants deposited by precipitation, such as rain and snow. One expression of wet deposition is precipitation pH, a measure of the acidity or alkalinity of the precipitation. Dry deposition refers to gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation. Total deposition refers to the sum of airborne material transferred to the Earth's surface by both wet and dry deposition. Total nitrogen deposition is calculated by summing the nitrogen portion of wet and dry deposition of nitrogen compounds, and total sulfur deposition is calculated by summing the sulfur portion of wet and dry deposition of sulfur compounds.

The normal range of precipitation pH is 5.0 to 5.6 (Seinfeld 1986). Annual average precipitation pH in 2008 was approximately 5.3 at the Poplar River station (Figures 14 and 15 in the *Air Resources and Climate Appendix*). The planning area has low nitrate and ammonium deposition compared to the rest of the United States (see Figure 20 of the *Air Resources and Climate Appendix*).

Total nitrogen compound deposition at Theodore Roosevelt National Park was 2.8 kg/ha-yr in 2006. Nitrogen compound speciation indicates that most nitrogen is deposited as wet ammonium (see Figure 16 of the *Air*

Resources and Climate Appendix). The planning area has low nitrate and ammonium deposition compared to the rest of the United States (see Figure 18 of the *Air Resources and Climate Appendix*).

With regard to sulfur compound deposition, approximately 1.1 kg/ha-yr of sulfur compounds were deposited at Theodore Roosevelt National Park in 2006 (see Figure 17 of the *Air Resources and Climate Appendix*), with wet sulfates accounting for the largest sulfur contribution.

TABLE 3-5.
FEDERAL CLASS I AREAS AND POTENTIAL SENSITIVE CLASS II AREAS IN OR NEAR THE PLANNING AREA

	Class I Area	Jurisdictional Agency
Class I Areas	Badlands Wilderness	NPS
	Fort Peck Indian Reservation	Tribal
	Lostwood Wilderness	USFWS
	Medicine Lake Wilderness Area	USFWS
	Theodore Roosevelt National Park	NPS
	UL Bend Wilderness Area	USFWS
	Wind Cave National Park	NPS
Potential Sensitive Class II Areas	Bowdoin National Wildlife Refuge	USFWS
	Charles M Russell National Wildlife Refuge	USFWS
	Crow Indian Reservation	Tribal
	Devil's Tower National Monument	NPS
	Lake Ilo National Wildlife Refuge	USFWS
	Lake Zahl National Wildlife Refuge	USFWS
	Lamesteer National Wildlife Refuge	USFWS
	Stewart Lake National Wildlife Refuge	USFWS
	White Lake National Wildlife Refuge	USFWS

Mercury wet deposition in the planning area is not well characterized. A mercury monitoring station located in the Lostwood Wilderness in North Dakota indicates mercury deposition is less than 4 $\mu g/m^3$, which is low compared to most areas of the United States (see Figure 19 of the *Air Resources and Climate Appendix*).

Atmospheric deposition can also cause acidification of lakes and streams. One expression of lake acidification is the change in acid neutralizing capacity, the lake's capacity to resist acidification from atmospheric deposition. Acid neutralizing capacity is expressed in units of micro-equivalents per liter (μeq/L). Lakes with acid neutralizing capacity values of between 25 to 100 μeq/L are considered to be sensitive to atmospheric deposition, those with values of between 10 to 25 μeq/L are considered to be very sensitive, and those with values of less than 10 are considered to be extremely sensitive (Fox et al. 1989).

Visibility

Visibility is a measure of how far and how well an observer can see a distant and varied scene. Pollutant particles in the atmosphere can impair scenic views, degrading the contrast, colors, and distance an observer is able to see. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. Light extinction 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 an approximate 10-percent change in light extinction. To estimate potential visibility impairment, monitored aerosol concentrations are used to estimate visibility conditions for each monitored day. Aerosol species affecting visual range include ammonium sulfate, ammonium nitrate, organic mass, elemental carbon, soil elements, and coarse mass.

Daily visibility values are 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, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon; the larger the standard visual range, the cleaner the air. Since 1980, the 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.

Three IMPROVE stations are located in the planning area, including one in the Fort Peck Indian Reservation, the Medicine Lake National Wildlife Refuge, and the Northern Cheyenne Indian Reservation. Three more IMPROVE stations are located near the planning area, including Theodore Roosevelt National Park (North Dakota), the North Absaroka Wilderness (Wyoming), and Yellowstone National Park (Wyoming).

The average standard visible range at the Fort Peck Indian Reservation IMPROVE monitor was 44 miles during the average haziest 20 percent of days and 135 miles during the clearest 20 percent of days. Similar standard visual range data are 58 to 171 miles at the Northern Cheyenne Indian reservation and 42 to 133 miles at the Medicine Lake Wilderness. Outside the planning area, nearby data indicate visual ranges of 57 to 168 miles at the UL Bend National Wildlife Refuge, 36 to 107 miles at Theodore Roosevelt National Park, and 76 to 182 miles at Yellowstone National Park.

Trends

Deposition

Precipitation pH trends are not discernible at the Little Bighorn Battlefield National Monument, Poplar River, Theodore Roosevelt National Park, and Glacier National Park (see Figures 14 and 15 in the *Air Resources Appendix).*

Nitrogen and sulfur deposition at Theodore Roosevelt National Park was variable between 1999 and 2006 (see Figures 26 and 27 in the *Air Resources and Climate Appendix*).

Visibility

Visibility has remained relatively constant over the last 6 to 10 years in the planning area and nearby areas. Standard visual range trends are illustrated for four IMPROVE stations in Figures 24 through 27 of the *Air Resources and Climate Appendix*. From 1996 through 2006, visibility on the 20 percent worst visibility days remained constant at all Montana, Wyoming, and North and South Dakota monitors, except for a slight increase in haze (orange arrow) in the Gates of the Mountains Wilderness and a slight decrease in haze (blue arrow) in Yellowstone National Park (Figure 3-6). When the 20 percent best visibility days are considered, haze decreased throughout eastern Montana, the western Dakotas, and Wyoming while remaining relatively constant or decreasing slightly in western Montana.

SMOKE MANAGEMENT

Smoke management indicators include concentrations of carbon monoxide and particulate matter.

Current Conditions

Smoke management for prescribed fire activity in the study area is managed by the Montana/Idaho Airshed Group (more information is available at http://www.smokemu.org/) under the authority of the Montana Open Burning Regulations (ARM Title 17, Section 8, Subchapter 6). The planning area is contained in Airsheds 9 and 10. Average annual prescribed burn acres for Airshed 10 are about 3,850 acres.

Trends

Smoke management remained approximately the same in the planning area from 2005 to 2011.

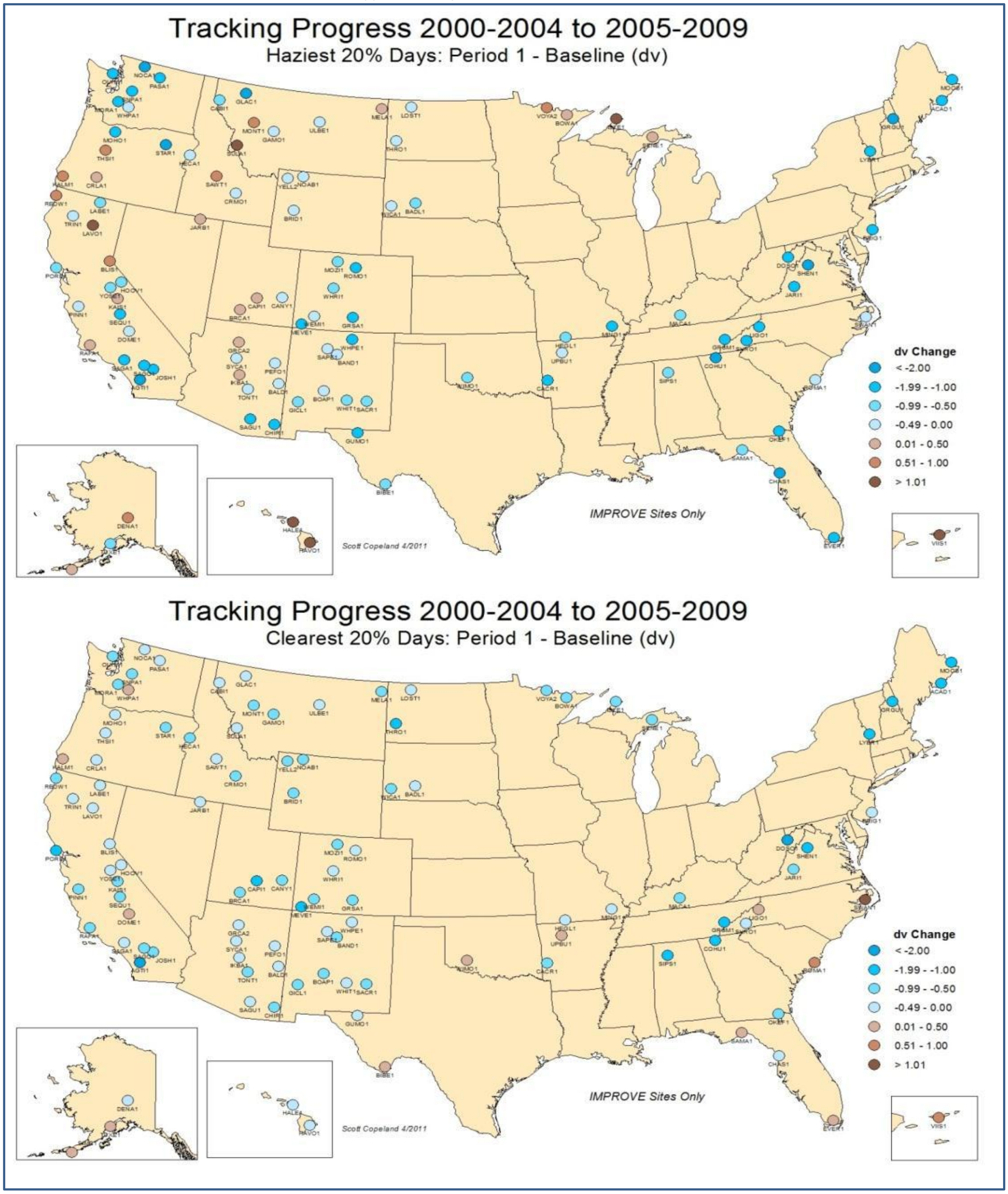
NOISE

Noise is unwanted sound. Sound-measurement equipment has been designed to adjust the actual sound pressure to correspond with human hearing. A-weighted correction factors deemphasize the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise. The dBA measurement is based on a logarithmic scale of sound pressure. Assuming 60 dBA is the noise level experienced in normal conversation with two people standing 5 feet apart, a noise of 50 dBA would be half as loud, and a noise of 70 dBA would be twice as loud. For humans, a change in sound level of 3 dBA is generally just noticeable when the intruding noise is of a similar character to the background noise (e.g., an increase in existing traffic noise), and a change of 5 dBA would clearly be noticeable. However, when the intruding noise is of a different character than the background noise (e.g., a motorcycle within existing car traffic), a noise level less than 1 dBA may be discernible.

Great Plains toad in the planning area

Badlands creek in southeastern Montana

FIGURE 3-6.
HAZE TRENDS ON THE 20 PERCENT BEST AND WORST VISIBILITY DAYS



Source: Hand et al. 2011

SOILS

Soils are the foundation of terrestrial ecosystems, which are driven by soil potential and productivity, and the quality of ecosystem services and renewable resources depend on the health of the soil system. Consequently, maintaining soil resilience is fundamental for ecosystem recovery from disturbance (natural or anthropogenic).

Over time, soils, which develop through the actions climate and biota exert on parent material, are further altered by topography and land management. Such soil-forming factors are variable across the planning area, resulting in dynamic soils with diverse physical and chemical properties). Soils in the planning area have generally developed from sedimentary parent material (sandstone, siltstone, limestone, and shale) from the Fort Union formation. Soil textures range from very gravelly to clays. The planning area is characterized by gently rolling hills interrupted by scoria ridges, rugged badlands, buttes, and the breaks of major rivers. Soils are commonly calcareous, poorly developed, and contain few coarse fragments. See the *Soils Appendix* for more soil resource information.

The planning area's soils are grouped into two Land Resource Regions, the Northern Great Plains Spring Wheat Region and the Western Great Plains Range and Irrigated Region. Soils are then grouped into Major Land Resource Areas, which are described in the *Soils Appendix*. Although there are eight Major Land Resource Areas in the planning area, the primary Major Land Resource Area is the northern rolling high plains-northern part (NRCS 2006).

Healthy soils maintain air and water quality and biotic productivity. Naturally functioning soil systems sustain biotic activity, diversity, and productivity; capture, store, and release water; store and cycle nutrients; filter, buffer, degrade, immobilize, and detoxify contaminants; and provide biotic system habitat. Such functions are determined by the soil system structure, which includes physical properties (e.g., bulk density, texture, structure, parent material, and porosity), chemical properties (e.g., pH, salts, calcium carbonate, clay, and humus), and biotic properties (e.g., microorganisms, macroorganisms, and organic matter).

Soil biodiversity, which is important for ecosystem resilience (Perrow and Davy 2003), increases with increased soil heterogeneity (variable characteristics) because there are more niches to be filled by species. Biotic ground cover (including biological soil crusts and litter), plant roots, and organic matter additions promote water infiltration and storage, soil productivity, and stability. Microorganisms (e.g., mycorrhizae and bacteria) provide nutrients and aggregation and metabolize contaminates. Macroorganisms (e.g., worms) cycle nutrients and increase porosity.

Many invasive plants alter the soil environment through allelopathy or by reducing soil fertility or moisture, which results in accelerated erosion and altered biodiversity (DiTomaso 2000; Radosevich et al. 2007). Surface-disturbing actions and changes to soil moisture content and chemical characteristics (e.g., from produced discharge water) provide opportunities for the establishment of invasive plants.

The planning area evolved with large ungulate herbivory, predominantly by bison (*Bos bison*). Livestock grazing regimes enhance soil systems when they are used to mimic natural disturbance regimes that promote nutrient cycling, soil development, soil biodiversity, and vegetative ground cover. However, the action of trampling and trailing reduces ground cover, exposing soils to erosion and invasive vegetation associated with disturbed soil systems (Perrow and Davy 2003).

Although fires remove ground cover and expose soils to wind and water erosion, the magnitude of these effects is a function of the severity of the fire. Fires of low severity or intensity promote nutrient cycling (which increases the nutritional value and productivity of vegetation), soil development, and biodiversity (Arno and Allison-Bunnell 2002). Stand-replacing fires (fires of high severity) increase the risk of erosion and mass movement of unstable soils (Arno and Allison-Bunnell 2002). High-intensity fires sterilize soils, increase pH, reduce fertility, increase overland flow, or produce a hydrophobic surface layer, which inhibits water infiltration (Arno and Allison-Bunnell 2002). Fire suppression in conjunction with grazing, development, and nonnative vegetation has caused altered fire regimes in eastern Montana. Depending on the vegetation type, moderate to high departures from the natural regime have occurred (USFS and USDI 2007), resulting in altered erosion rates, soil development, nutrient cycling, and soil biodiversity.

Historic and ongoing activities adjacent to or within the planning area include mineral exploration and development, livestock grazing, on- and off-road vehicle use, recreation, infrastructure development, fire suppression, altered fire regimes, forestry, urbanization, invasive weed infestation, pollution, and agriculture. The cumulative effects of such activities have contributed to compaction, increased overland flow, mass movement, mixed soils, and accelerated erosion by wind and water and resulted in sedimentation and the irretrievable loss of topsoil and nutrients. Generally, within 2 to 5 years of reclamation, vegetative cover and rates of erosion have returned to pre-disturbance conditions (BLM 2008g). However, in some instances disturbance of sensitive soils has resulted in perpetually altered vegetation and erosion rates.

Surface disturbances have resulted in changes to soil structure, heterogeneity (variable characteristics), temperature regimes, nutrient cycling, biotic richness, and diversity. Mixed soils have decreased bulk density and altered porosity, infiltration, air-water relationships, salt content, and pH (Perrow and Davy 2003; Bainbridge 2007). Soil compaction has resulted in increased bulk density and reduced porosity, infiltration, moisture, air, nutrient cycling, productivity, and biotic activity (Logan 2001; Perrow and Davy 2003; Bainbridge 2007). Altering such characteristics has reduced the soil system's ability to adapt to climate change and withstand future disturbances.

Long-term impacts to disturbed soils include altered pH and reduced soil stability, organic matter content, microbial mass, biotic richness and diversity, and phosphorus and nitrogen content (Perrow and Davy 2003). Permanent impacts include altered texture class, rock fragment content, structure, and depth to bedrock. Such activities have also caused habitat fragmentation, which has resulted in altered soil heterogeneity, microclimate, hydrology, nutrient cycling, biotic richness, and diversity (Perrow and Davy 2003). In addition, natural disturbance regimes (e.g., fire and grazing) have been altered, resulting in altered rates of soil formation (Perrow and Davy 2003).

PROPOSED CARTER MASTER LEASING PLAN AREA

An area in Carter County has been identified for an oil and gas master leasing plan (MLP) (see *Oil and Gas* for more information on MLPs).The Carter MLP area contains sensitive soils and slopes greater than 25 percent (Table 3-6).

Soils within the proposed Carter MLP area are highly variable. The area is located within four watersheds (Hydrological Unit Code [HUC] 8; subbasins): Little Powder River (0.17 percent of the MLP area), Lower Powder River (2.9 percent), Upper Little Missouri River (1.7 percent), and Boxelder Creek (Little Missouri River) (24 percent) (USGS 2009). Soils in the area generally developed from the Pierre formation. Ecological sites are typically saline uplands or clayey (Major Land Resource Area 60B, 10 to 14 inches precipitation zone). Terrain within the MLP area varies, and slopes reach up to approximately 200 percent. Approximately 0.9 percent (approximately 850 acres) of BLM-administered surface lands have 25 percent slopes or greater. Approximately 67 percent (approximately 93,000 acres) of BLM-administered surface lands are considered poorly suited to reclamation while about 2 percent (approximately 3,200 acres) potentially contain hydric soils.

CLIMATE CHANGE

Soils can be either a source or a sink for the greenhouse gases carbon dioxide, methane, and nitrous oxide. Such gases are commonly produced by the decomposition of soil organic matter. Carbon dioxide and nitrous oxide are produced by the respiration of soil biota and the oxidation of aerated organic matter. Methane is respired by bacteria in flooded soils and metabolized by bacteria in aerated soils.

Organic matter is classified by its resistance to microbial decomposition. Passive organic matter (e.g., humus) is highly resistant to decomposition, remaining in soils for hundreds to thousands of years. Slow organic matter (e.g., wood) takes decades to decompose. Active organic matter (e.g., fine roots) is ephemeral, can be decomposed within a matter of months to years, and rarely makes up more than 20 percent of total organic matter content (Brady and Weil 2004). The amount of organic carbon in soils is variable and localized, and is dependent on additions from organic matter and removal by decomposition, fire, and erosion. However, soils can store a finite amount of carbon.

TABLE 3-6.
BLM-ADMINISTERED SOIL ACRES WITH OIL AND GAS DEVELOPMENT POTENTIAL IN THE PROPOSED CARTER MASTER LEASING PLAN AREA

Type of Acres	Acres of Sensitive Soils	Acres of Slopes 25% or Greater
High Oil and Gas Development Potential Surface Acres	6,200	71
High Oil and Gas Development Potential Mineral Acres	17,000	320
Medium Oil and Gas Development Potential Surface Acres	47,000	240
Medium Oil and Gas Development Potential Mineral Acres	74,000	580
Low Oil and Gas Development Potential Surface Acres	43,000	540
Low Oil and Gas Development Potential Mineral Acres	77,000	1,100

Active organic carbon is quickly degraded by disturbances such as fire or surface-disturbing actions. Conversely, reclaimed soils can recover active organic carbon within a few years of disturbance. Although much research is being conducted on carbon storage in soils, there is insufficient information available to estimate existing carbon stocks and storage potential within the planning area.

Changes to the climate within the planning area may affect soils in various ways, including altered ground cover, soil biota, organic matter, temperature, moisture, decomposition rates, and erosion and deposition. For example, increased temperatures in conjunction with increased precipitation (as is predicted for winter and spring months) would result in increased rates of nutrient cycling. However, increased temperatures and decreased precipitation (as is predicted for summer months) would result in reduced soil moisture, loss of ground cover, and increased wind erosion. Increased occurrence or magnitude of high precipitation events would increase water erosion from overland flow**,** flooding, or mass movement. Reduced subsurface recharge would decrease the extent of hydric soils. Soil formation would be altered in areas of increased fire occurrence. For example, badlands may have formed within the planning area because of stand-replacing fires in areas of fine soils, which established a perpetual cycle of erosion (Hansen et al. 2008). Soil properties would be altered in areas in which invasive plant populations expanded. Increased carbon dioxide would increase cool season species growth resulting in increased organic matter.

DATA SOURCES

Soils within the planning area have been mapped and interpreted for land use and the information is available by county from the Natural Resources Conservation Service (NRCS) (2009b) through the Soil Survey Geographic Database. This database is used for site-specific evaluations, although on-site evaluations may also be recommended. Soil Survey Geographic Database Ecological Site Descriptions are often used to evaluate site potential. Field observations and previous National Environmental Policy Act (NEPA) analyses may be used in site-specific evaluations. Rangeland health and proper functioning condition (PFC) assessments are commonly used to evaluate soil health (see the *Vegetation Appendix*). General soil information can be found in the United States General Soil Map Database for Montana, known as STATSGO2, also provided by the NRCS.

IMPORTANT SOIL CHARACTERISTICS

Impacts to prime farmland were not analyzed in the RMP. Prime farmland includes those agricultural lands best suited to producing food, forage, feed, fiber, and oilseed crops. Although soils considered prime farmlands (if irrigated) occur within the planning area, the unavailability of dependable water in these areas prevents their classification as prime farmland.

Soils sensitive to disturbances occur within the planning area (Table 3-7); these soils would be difficult to reclaim following degradation. Criteria used to determine soil sensitivity to surface uses is continually adapted as conditions change or new information or technology becomes available. The following site characteristics are considered to be at high risk of degradation from disturbance: soils poorly suited to reclamation, soils on steep slopes, highly compactable soils, and hydric soils.

Reclamation suitability describes the ability of the soil resource to restore functional and structural integrity following disturbance. The rate and degree of recovery is dependent on the action, time of year, and various site characteristics. Soils poorly suited to successful reclamation contain characteristics that include high salt content, limited precipitation, poor water-holding capacity, inadequate rooting depth, or highly erosive qualities (see *Soils Appendix*).

TABLE 3-7.
SENSITIVE SOIL RESOURCES IN THE PLANNING AREA

Soil Classification	Acres in the Planning Area[1]
Sensitive Soils	1,639,000
Hydric Soils	106,000
Soils with Poor Reclamation Suitability	1,549,000
Slopes 25 percent or Greater	154,000
Highly Erodible Soils in the Big Dry RMP Area	159,000
Slopes greater than 15 percent in the Big Dry RMP Area	284,000
Slopes 30 percent or Greater	90,000
Slopes 40 percent or Greater in the Big Dry RMP Area	15,000

[1]Acre figures may overlap, and adding these figures will not result in accurate total acreage values.

The planning area contains naturally erosive soils. Key factors used to determine erodibility within the planning area are percent slope, Kw factor values, and wind erodibility index values. The Kw factor expresses the effects of sheet and rill erosion and is determined by soil characteristics that include texture, rock fragments, organic matter, structure, and saturated hydraulic conductivity. Texture, clod composition, organic matter, rock fragments, and calcium carbonate determine the wind erodibility index. Disturbances that remove vegetation and other ground cover result in soil loss beyond natural rates (accelerated erosion); the loss of topsoil and nutrients degrades site productivity.

Steep slopes (approaching 30 percent or greater) have a high risk of water erosion and mass movement following disturbance (Monsen, Stevens, and Shaw 2004). Management actions on steep slopes that alter ground cover, structure, permeability, and bulk density result in water erosion (Monsen et al. 2004). Vegetative cover is essential to soil stability on steep slopes, and water erosion severely limits reclamation potential once vegetation is removed. Successful revegetation decreases with increasing slope, particularly for slopes greater than 20 percent (Monsen et al. 2004).

Accelerated eroded material transported and deposited into water systems (sediment) is considered a pollutant (MDEQ 2007; USEPA 2009c). Sedimentation alters stream conditions by increasing salt content, adding contaminants, reducing sunlight, changing temperatures, abrading or suppressing organisms, or smothering eggs. Nutrients in eroded topsoil such as nitrogen and phosphorous can cause eutrophication (enriched nutrient levels), which results in algal and vegetative blooms that reduce oxygen levels in waterbodies. Approximately 60 percent of water-eroded soil enters streams (Pimentel 1998).

Moist, but not saturated, soils with shallow depth to saturation, clayey texture, high organic matter content, and minimal rock fragment are very susceptible to compaction. Affected soils have increased bulk density and reduced porosity, infiltration, moisture, air, nutrient cycling, productivity, and biotic activity (Logan 2001; Perrow and Davy 2003; Bainbridge 2007). Soil compaction from mechanized and livestock uses degrades hydrologic (e.g., infiltration and storage) and nutrient cycling processes, resulting in increased overland flow, accelerated erosion, and sedimentation (Perrow and Davy 2003). Moderate traffic can reduce infiltration rates by up to 75 percent of natural rates (Bainbridge 2007).To some extent, annual freeze and thaw action, root penetration, or the shrink-swell action of clays alleviate compaction.

Hydric soils are formed during saturated soil conditions, becoming anaerobic in the upper horizons. Properly functioning riparian and wetland soils are highly productive and capture and store water, recharge aquifers and streams, dissipate flow energy, reduce erosion and sedimentation, and filter contaminants (Lewis et al. 2003). Functional soils are protected by vegetation that dissipates flow energy, and the removal of this vegetation results in accelerated water erosion and sedimentation. Because hydric soils contain high organic matter and moisture content, they are very susceptible to compaction. Compaction of these soils would potentially degrade hydrologic function and nutrient cycling. Desiccation resulting from surface disturbances would reduce organic matter content (producing carbon dioxide and nitrous oxide) and increase surface salts (which are toxic to biota).

WATER RESOURCES

Water resources across the planning area are present as surface water (e.g., rivers, streams, creeks, coulees, springs, reservoirs, lakes, ponds, wetlands, and canals) and groundwater from a variety of geologic strata. Water resources are essential to the residents of eastern Montana to support agriculture, public water supplies, industry, and recreation. Water resources, wetlands, and riparian health are crucial to the survival of numerous migratory bird species and BLM-designated sensitive birds, fish, reptiles, and amphibians.

WATERSHED CONDITION

The planning area is located within the Upper Missouri River basin of the Missouri River Hydrologic Region. Hydrologic subbasins in the planning area, defined by the USGS National Hydrography Dataset (i.e., 4^{th} order watershed), include the Beaver, Big Porcupine, Boxelder, Brush Lake, Charlie-Little Muddy, Fort Peck Reservoir, Little Dry, Little Powder, Lower Belle Fourche, Lower Musselshell, Lower Powder, Lower Tongue, Lower Yellowstone, Lower Yellowstone-Sunday, Middle Little Missouri, Middle Musselshell, Middle Powder, Mizpah, O'Fallon, Poplar, Porcupine, Prairie Elk-Wolf, Redwater, Rosebud, Upper Little Missouri, Upper Tongue, and the West Fork Poplar watersheds (Map 51).

Watershed condition is determined by the physical and biological characteristics and processes that impact the function of a watershed. Watershed functionality includes hydrologic and ecologic functions (such as collection and transportation of precipitation and water storage and release) and characteristics (such as sites for plant and animal habitat and chemical reactions). Properly functioning or "healthy" watersheds have high biotic and soil integrity and connectivity, are resilient to disturbance, maintain water quality and quantity, recharge aquifers, and maintain riparian communities (Potyondy 2010).

Disturbance in upland areas impact watershed hydrology by causing the removal of vegetation, exposing the soil to erosion, and contributing to soil compaction. Vegetation condition influences the quantity and quality of water within the watershed. Healthy vegetation communities provide ground cover, which facilitates infiltration, reduces overland and peak flows, and maintains base flows (WDFG 2010a).

Soil erosion affects water quality. Erosion introduces metals, salts, chemicals, and nutrients (such as nitrogen, phosphorus, and sulfur) to water. Soil erosion can cause eutrophication in addition to altering water chemistry, increasing sedimentation, and increasing increased total dissolved solids (TDS). Fertilizer application, livestock grazing, feedlots, septic tanks, atmospheric deposition, and the release of sewage to water can also cause eutrophication. Eutrophication (high plant productivity and increased biomass of algae and other aquatic plants) is often caused by increases in nutrient levels, which can cause decreased water clarity, increased TDS, alteration of food webs, lower dissolved oxygen, higher pH, changes in community composition, and channel flow impediments. Algal blooms can contribute to taste and odor problems for drinking water and can be toxic to aquatic life or humans.

SURFACE WATER

Surface water in the planning area is capable of supporting a variety of beneficial uses (Table 3-8). Surface water is the primary source for all water use in Montana, representing 97 percent of the total water use throughout the state (Kenny et al. 2009). Most of the planning area is sparsely settled and land use consists primarily of family and cooperative ranches, coal mining, and oil and gas development. Irrigation is the predominate use of surface water, composing approximately 95 percent of the total surface water withdrawn.

Thermoelectric power production (2.9 percent), livestock use (0.4 percent), public water supply (0.9 percent), industrial (0.4 percent), mining (0.2 percent), domestic water (less than 0.01 percent), and aquaculture (less than 0.01 percent) account for the remaining surface water use in the planning area (USGS 2005).

Hess Island along the Yellowstone River near Marsh, Montana.

Windmill project for fish habitat at Homestead Reservoir in Prairie County.

TABLE 3-8.
2005 SURFACE WATER WITHDRAWALS FOR COUNTIES IN THE PLANNING AREA

County	Millions of Gallons per Day								
	Public Supply	Domestic	Industrial	Irrigation	Livestock	Aquaculture	Mining	Thermoelectric	Total
Big Horn	0.84	0.00	0.00	267.34	0.28	0.00	2.67	0.00	**271.13**
Carter	0.00	0.01	0.00	8.37	0.89	0.00	0.23	0.00	**9.50**
Custer	1.38	0.00	0.00	117.87	1.10	0.01	0.01	0.00	**120.37**
Daniels	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00	**1.62**
Dawson	1.52	0.00	0.00	50.36	0.51	0.00	0.00	0.00	**52.39**
Fallon	0.00	0.00	0.00	0.24	0.64	0.00	0.00	0.00	**0.88**
Garfield	0.00	0.00	0.00	14.50	0.76	0.00	0.00	0.00	**15.26**
McCone	0.00	0.00	0.00	25.80	0.19	0.00	0.00	0.00	**25.99**
Powder River	0.00	0.00	0.00	38.58	0.07	0.00	0.00	0.00	**38.65**
Prairie	0.00	0.00	0.00	52.39	0.36	0.00	0.00	0.00	**52.75**
Richland	0.00	0.00	0.87	349.47	0.82	0.00	0.08	20.07	**371.31**
Roosevelt	0.11	0.00	0.00	89.54	0.40	0.00	0.00	0.00	**90.05**
Rosebud	0.68	0.00	0.00	210.94	0.82	0.00	2.03	27.80	**242.27**
Sheridan	0.05	0.00	0.00	3.44	0.32	0.00	0.00	0.00	**3.81**
Treasure	0.14	0.00	0.00	71.07	0.36	0.00	0.00	0.00	**71.57**
Valley	1.00	0.02	0.00	229.64	0.81	0.00	0.05	0.00	**231.52**
Wibaux	0.00	0.00	0.00	1.80	0.22	0.00	0.03	0.00	**2.05**
Total	**29.35**	**0.03**	**11.09**	**2,971.59**	**11.65**	**0.01**	**6.25**	**89.62**	**3,119.59**

Source: USGS 2005
Portions of the Fort Peck Reservoir, Porcupine, Upper Tongue, Rosebud, Lower Yellowstone-Sunday, and West Fork Poplar watersheds occur outside of the planning area

The Missouri and Yellowstone rivers are the largest rivers in the planning area, draining 91,557 and 69,083 square miles respectively (Table 3-9). The Missouri River flows to the east and drains the northern portion of the planning area, with an average annual discharge of 7,272,000 acre-feet per year near Culbertson, Montana (USGS 2009a). The planning area includes the portion of the Missouri River located directly below Fort Peck Reservoir and east to the North Dakota border. Major tributaries of the Missouri River include the Big Dry and Box Elder creeks and the Little Missouri, Musselshell, Poplar, and Redwater rivers. Flowing northeast to the Missouri River, the Yellowstone River drains the southern and eastern portion of the planning area with an average annual discharge of 8,557,000 acre-feet per year near Sidney, Montana (USGS 2009b). Major tributaries of the Yellowstone River include the Rosebud, Otter, Armells, Hanging Woman, Mizpah, and O'Fallon creeks and the Little Powder, Powder, and Tongue rivers.

According to the USGS National Hydrography Dataset, approximately 121,000 miles of streams and rivers are located within the planning area. Of these, approximately 13,000 miles (11 percent) of streams and rivers flow across BLM-administered lands. Perennial streams retain water year round and flow regimes are variable and subject to meteorological conditions. Intermittent streams do not flow year round. Discharge occurs during periods of sufficient input of groundwater or surface water sources such as snowmelt or rainstorms. Typically, ephemeral (which flow only in direct response to precipitation) and intermittent streams conduct water to perennial streams. More than 97 percent of stream miles in the planning area are intermittent and ephemeral. Intermittent and ephemeral streams play an important role in the hydrologic function of the ecosystems of the planning area by transporting water, sediment, nutrients, and debris through the stream network and providing connectivity within a watershed. These streams filter sediment, dissipate energy from snowmelt and storm water runoff, facilitate infiltration, and recharge groundwater (Levick et al. 2008). The pools within intermittent streams retain water in the dry months, supporting riparian vegetation and providing water resources for wildlife and livestock.

A number of factors (including streamflow regime, topography, geology, soils, vegetation, climate, and land use history) influence stream morphology. Stream conditions on BLM-administered land within the planning area reflect a number of historical and current impacts, such as agriculture, mining, and oil and gas development. Tertiary bedrock (sandstones, siltstones, shales, and scoria), alluvium, and glacial till represent the surface geology in the planning area. This parent material tends to form highly erosive fine-grained soils (loams to silt loam). Streambeds typically consist of sand and silt, with few bedrock channels. Since streambeds and streambanks generally lack control features (e.g., rocks, cobbles, and bedrock), stream morphology and stability is highly influenced by the presence and type of riparian vegetation. These systems have high levels of natural instability and rapid degradation can occur from human disturbance (Elmore and Kauffman 1994). The potential for invasion by nonnative species is increased when development alters physical conditions (i.e., stabilizes flow regimes or reduces sediment loads) (WDFG 2010a).

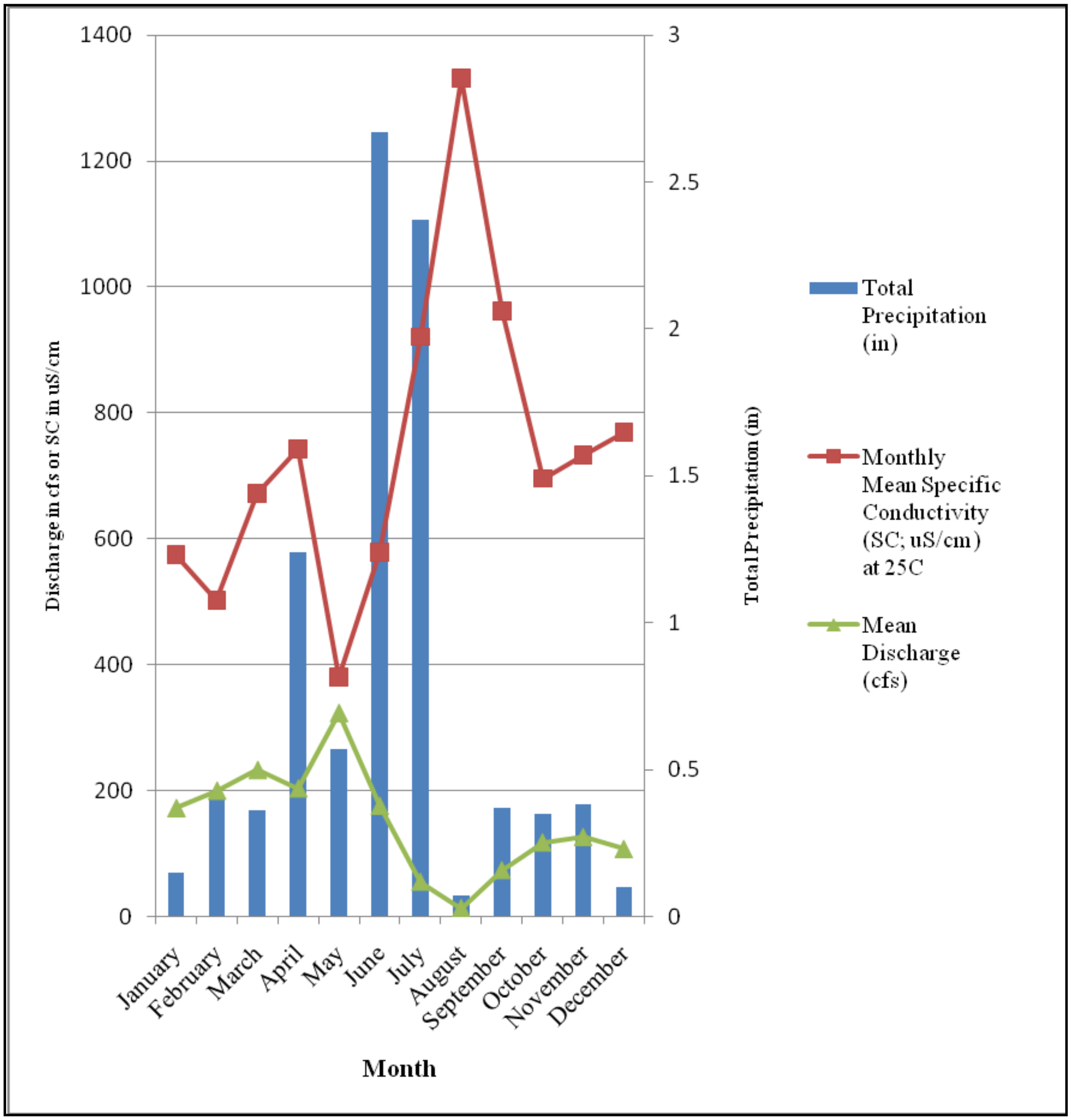
The planning area climate is semi-arid to arid. The majority of the planning area receives less than 15 inches of precipitation annually. Typically, high runoff from snowmelt causes the highest streamflow across the planning area from May to June. Intense summer storms contribute to moderate flow rates that continue into July. The Tongue River near Decker, Montana, illustrates this typical annual flow pattern (Figure 3-7).

Generally, there is an inverse relationship between in-stream flow (discharge) and salinity concentrations (electrical conductivity [EC]). EC is the ease with which electric current will pass through a water sample, and is proportional to the salinity of the sample (microSiemens per centimeter [µS/cm]). During the winter, in-stream flow rates are relatively low and salinity concentrations and sodium adsorption ratios (SAR) are high because stream flow is fed by saline, groundwater with a higher SAR (base flow). Because groundwater is in contact with soil and bedrock for extended periods, it contains higher concentrations of dissolved solids (ions such as chloride, sodium, potassium, calcium, magnesium, sulfate, and bicarbonate) than meteoric water (snowmelt) and therefore has a higher EC. Conversely, during periods of heavy overland flow (May, June, and July), the groundwater contribution (base flow) is diluted by precipitation while meteoric water and salinity values are lower.

TABLE 3-9.
RIVERS AND STREAMS IN THE PLANNING AREA BY SUBBASIN

HUC	Subbasin	Total Stream Miles (BLM-administered land)	Total Stream Miles	Subbasin Area within the Planning Area (mi^2)
Subbasins Draining to the Missouri River				
10110204	Beaver	6	1,050	461
10040105	Big Dry	564	4,654	1,547
10060006	Big Muddy	4	5,514	2,471
10110202	Box Elder	836	3,400	1,145
10060007	Brush Lake Closed	0	122	277
10060005	Charlie-Little Muddy	193	3,332	1,162
10040104	Fort Peck Reservoir	1,537	6,288	2,086
10040106	Little Dry	277	3,437	1,222
10120202	Lower Belle Fourche	156	305	83
10050012	Lower Milk	0	210	80
10040205	Lower Musselshell	445	2,229	706
10110203	Middle Little Missouri	27	201	72
10040202	Middle Musselshell	63	1,529	396
10060003	Poplar	<1	3,696	1,293
10050016	Porcupine	0	1,187	340
10060001	Prairie Elk-Wolf	611	6,233	1,950
10060002	Redwater	161	7,836	2,113
10110201	Upper Little Missouri	959	5,270	1,759
10060004	West Fork Poplar	0	1,507	573
Subbasins Draining to the Yellowstone River				
10100002	Big Porcupine	257	3,184	872
10090208	Little Powder	269	1,997	652
10080015	Lower Bighorn	0	393	122
10090209	Lower Powder	1,333	5,653	1,876
10090102	Lower Tongue	513	8,873	2,871
10100001	Lower Yellowstone-	1,251	14,593	4,534
10100004	Lower Yellowstone	1,796	14,141	4,577
10090207	Middle Powder	415	2,057	714
10090210	Mizpah	189	2,407	803
10100005	O’ Fallon	599	4,237	1,578
10100003	Rosebud	82	3,303	1,138
10090101	Upper Tongue	194	2,526	831
	Total	**12,738**	**121,364**	**40,304**

FIGURE 3-7.
MEAN MONTHLY FLOW AND PRECIPITATION VERSUS ELECTRICAL CONDUCTIVITY FOR THE TONGUE RIVER NEAR DECKER, MONTANA, FOR 2001



The variability of surface water quality presents challenges to water users, specifically irrigators, since irrigation with saline water results in reduced crop yield (Hill and Koenig 1999). Higher sodium concentrations (sodic) are of concern in the Powder River and Mizpah Creek drainages. Irrigation with sodic water can adversely affect crop growth (by creating calcium, potassium, and magnesium deficiencies) and affect the physical properties of soils by promoting crusting and impeding drainage in soils containing large amounts of clay (see the *Soils Appendix*).

The planning area contains approximately 40,000 known lakes, reservoirs, and ponds; 3,300 (8 percent) are located on BLM-administered lands within the planning area and support beneficial uses including irrigation, stock water, recreation, fisheries, and wildlife. The majority of these features consist of small ponds and impoundments (less than 1 acre) built across intermittent streams to capture spring runoff for stock use during the summer months (Table 3-10). There are numerous undocumented stock ponds, dugouts, and small impoundments across the planning area.

Surface water impoundments have altered the natural hydrologic regime of streams and rivers by reducing streamflow, dissolved oxygen, and floodplain size and extent downstream (Vorosmarty 2000); increasing infiltration to groundwater, scour of the downstream streambed, and water temperature (Dodds 2004); substantially increasing evaporative losses; degrading water quality; and changing nutrient cycling, timing, and magnitude of peak and low flows, sediment load, and riparian vegetation recruitment and succession.

TABLE 3-10.
SIZE AND SUMMARY OF WATERBODIES IN THE PLANNING AREA

Size (acres)	Number of Waterbodies (BLM-administered land)	Percentage (%) of Waterbodies (BLM-administered land)	Number of Waterbodies	Percentage (%) of Waterbodies
Less than 1	1,784	54.1	26,206	65.5
1 to 1.9	629	19.1	6,292	15.7
2 to 4.9	581	17.6	4,825	12.1
5 to 9.9	175	5.3	1,626	4.1
More than 10	127	3.9	1,055	2.6

According to the USGS National Hydrography Dataset, there are 1,920 known springs and seeps in the planning area (80 of which are on BLM-administered lands) and numerous undocumented springs. Springs are important for aquatic habitat, biodiversity support; sustained streamflow, wetland and riparian vegetation community support, and as a water source for livestock, wildlife, or drinking.

The planning area contains approximately 1.4 million acres of 100-year floodplains, of which 42,000 occur on BLM-administered surface acres and 330,000 on BLM-administered mineral estate acres. Floodplain function is essential to watershed function, water quality, soil development, stream morphology, and wetland and riparian community composition (Scott 1997). Floodplains reduce flood peaks and velocities, thereby reducing erosion; enhancing nutrient cycling; reducing frequency and duration of low flows; and increasing infiltration, water storage, and aquifer recharge. Floodplains enhance water quality by facilitating sedimentation and filtering overland flow. Floodplains support high plant productivity, high biodiversity, and habitat for wildlife. Hydrologic modification via water diversions, dams, and channelization have altered the natural flooding regime across the planning area and reduced or eliminated floodplain functionality.

Hydrologic modification and channelization, in addition to other factors, have led to a decline in riparian forests across the Great Plains, in particular cottonwood species (*Populus sp.*). Cottonwood communities reduce sedimentation and floodwater velocity and provide critical erosion control, large woody debris input, thermal cover, and streambank stability (Hansen 2008). Periodic flooding is essential to riparian communities of active floodplains (Eubanks 2004). In particular, plains cottonwood (*Populus deltoides*) recruitment is dependent on flood scour and the maintenance of the historical magnitude, frequency, and duration of floods of a recurrence interval of 9.3 years or greater (Scott 1997).

WATER QUALITY

Surface water and groundwater quality can be affected by point or nonpoint source pollution. Point source pollution originates from a discernible, confined, and discrete conveyance from which pollutants are discharged. It is regulated by the State under the Montana Pollution Discharge Elimination System (MPDES). Common sources are concentrated animal feeding operations, construction, mining, and industrial activity. Nonpoint source pollution is Montana's largest source of water quality impairment. Nonpoint source pollution originates from diffuse sources of contamination and is transported to waterbodies through precipitation, infiltration, and overland flow. Common sources are land use activities such as agriculture, forestry, urban development, and mining. Common contaminants from nonpoint source pollution are sediment, nutrients, temperature, heavy metals, pesticides, pathogens, and salt. Wetlands and riparian areas in PFC can significantly reduce the impacts of nonpoint source pollution by buffering adjacent waterbodies (MDEQ 2007).

The MDEQ *Montana Nonpoint Source Management Plan* outlines nonpoint source pollution problems and establishes goals, objectives, and strategies for controlling nonpoint source pollution on a statewide basis (MDEQ 2007). The goal of the Montana Nonpoint Source Management *Program* is to reduce and eliminate the impacts of nonpoint sources of pollution on water quality. As a component of the Montana Nonpoint Source Program, the BLM and MDEQ developed the memorandum of understanding (MOU) Regarding Water Quality Management on Bureau of Land Management Lands in Montana to cooperatively manage and control nonpoint source pollution from BLM-administered lands and authorizations (BLM and MDEQ 2010). Under the MOU, the BLM will work to reduce nonpoint source pollution and improve water quality, watershed health, and riparian health on BLM-administered lands. The MOU also provides the mechanism for ensuring project consistency with the State's Nonpoint Source Management Program (BLM and MDEQ 2010).

As waterbodies are assessed by the MDEQ for water quality, they are classified into Water Quality Categories (see the *Water Appendix*). When water quality monitoring data reveal that a waterbody does not attain water quality standards, the water is considered impaired (does not meet standards), or threatened (is likely to violate standards in the near future). More precisely, the specific beneficial use is, or will, become impaired. Under the requirements of Sections 208 and 303(e) of the Clean Water Act, any water found to have one or more threatened or impaired use must be placed on a list (303(d)) for which water quality management plans must be developed to correct the cause of the identified impairments. In cases where the impairment involves the need to reduce the load (amount or concentration) of specific pollutants in the water, the water quality management planning process must include the determination of a total maximum daily load (TMDL) for each pollutant exceeding the standard. The planning area includes all or portions of 14 TMDL planning areas in various TMDL development stages (see the *Water Appendix*). The MDEQ has determined that no TMDLs are required to be submitted to the USEPA for the Lower Musselshell TMDL Planning Area but has approved a Water Quality Restoration Plan (MDEQ 2001). The MDEQ has prepared a *Draft Redwater River Nutrient and Salinity TMDLs and Framework Water Quality Improvement Plan* that addresses nutrient- and salinity-listed waters but not sediment-listed waters (MDEQ 2010a).

In the planning area, 62 waterbodies were listed as impaired in the MDEQ's 2010 *Water Quality Integrated Report* (303(d)/305(b)). The 303(d) list is a subset (one or more impairments caused by a pollutant and requiring a TMDL to be completed and approved by the USEPA; Water Quality Category 5) of all waterbodies listed in the comprehensive 305(b) Water Quality Report. Within the planning area, there are 3,470 miles of rivers and streams on the 303(d) list (62 percent of the total miles) (see Table 3 in the *Water Appendix*). Of these, 117.4 miles occur on BLM-administered land. There are four lakes and reservoirs (totaling 135,900 acres) on the 303(d) list (out of 5 total reservoirs; 99 percent of the total acres) (see Table 4 in the *Water Appendix*). Of these, 4.8 acres occur on BLM-administered land.

The 2010 impaired and threatened waterbodies fail to support one or more beneficial uses under a number of parameters. The most common sources of water impairment are phosphorus, alteration in stream-side or littoral vegetative covers, iron, and total Kjehldahl nitrogen. The most common causes of impairment in the planning area are natural sources; unknown sources; agriculture, including irrigated crop production; grazing; and hydrostructure and flow alterations (see Table 2 in the *Water Appendix*) (MDEQ 2010).

Out of 5,576 total miles of rivers and streams, 643 miles (12 percent) fully support all beneficial uses (Water Quality Category 1) and 3,935 miles are impaired or threatened (including the 303(d) list)) (72 percent). There are four lakes and reservoirs within the planning area on the impaired or threatened list (including the 303(d) list) totaling 135,900 acres (out of five total reservoirs; 99 percent of the total acres). A 2010 list of impaired and threatened waters within the planning area appears in the *Water Appendix*.

Out of 230.8 total miles of rivers and streams occurring on BLM-administered lands in the planning area, 38.6 miles (17 percent) fully support all beneficial uses (Water Quality Category 1) and 128.6 miles are impaired or threatened (including the 303(d) list) (56 percent). The Tongue River Reservoir (4.8 acres) is the only impaired reservoir or lake occurring on BLM-administered land in the planning area.

GROUNDWATER

Within the planning area, useable aquifers occur at various depths. These resources are valuable for residents and may be the only water source available in some parts of the planning area. Although groundwater represents less than 3 percent of the total water use in the state (Solley, Pierce, and Perlman 1998), it is extremely important because it provides almost 100 percent of the domestic water used by farmsteads and constitutes the largest percentage of dependable stock water (Table 3-11). Irrigation is the predominate use of groundwater, composing 64.0 percent of the total groundwater withdrawn. Public water supply (12.5 percent), livestock use (9.9 percent), domestic water (7.0 percent), mining (4.4 percent), industrial (2.0 percent), thermoelectric power production (0.2 percent), and aquaculture (less than 0.01 percent) account for the remaining groundwater use in the planning area (USGS 2005). According to the Montana Bureau of Mines and Geology (MBMG) in 2009, there were approximately 37,000 groundwater wells across eastern Montana (Carter, Powder River, Rosebud, Treasure, Custer, Fallon, Wibaux, Prairie, Garfield, McCone, Dawson, Richland, Valley, Roosevelt, Daniels, and Sheridan counties) (MBMG 2009). See the *Water Appendix* for more information regarding groundwater well aquifer use by county.

The planning area is within the Northern Great Plains regional aquifer system, which is one of the largest confined aquifer systems of the United States. This aquifer system comprises primarily Tertiary and Cretaceous sandstone aquifers, Paleozoic carbonate aquifers, and confining units that can be discontinuous locally, but which function as a single aquifer. This regional aquifer system underlies part of North Dakota, South Dakota, Montana, Wyoming, and Canada. Unconsolidated glacial and alluvial deposits overlie the system, and low-yield, crystalline rocks underlie, the system. The regional flow paths trend southwest to northeast. Recharge occurs at high altitudes and travels down the dip of the aquifers before travelling upward to discharge into shallower aquifers or onto the land surface. Much of the water moves into and through the Powder River and the Williston structural basins (Miller 1999). Within the planning area, the primary bedrock aquifers occur in sandstones and coal beds composing the Tertiary Fort Union formation and sandstones composing the Cretaceous Hell Creek and Fox Hills formations.

Forty-four percent of the wells in eastern Montana access shallow aquifers less than 100 feet deep (Table 3-12 and Table 5 in the *Water Appendix*). Surficial aquifers within the planning area generally consist of Quaternary alluvium and undifferentiated Quaternary and Tertiary sediments (e.g., fluvial sand and gravel deposits, terrace gravels, and Flaxville formation gravels) (Zelt, Boughton, Miller, Mason, and Gianakos 1999). Water moves along local flow paths and typically discharges to streams and springs or recharges underlying regional aquifer systems (Miller 1999). Alluvial aquifers are among the most productive sources of groundwater within the planning area and occur in floodplains, terrace deposits, and along the channels of larger streams, tributaries, and rivers. They are typically 0 to 40 feet thick, but can attain thicknesses up to 250 feet. Although the quality of groundwater from alluvial aquifers is generally good, it can be highly variable (approximately 100 to 2,800 mg/L TDS and specific conductance of 500 to 125,000 µS/cm, with SAR of 5 to 10). Wells completed in coarse sand and gravel alluvial aquifers can yield as much as 100 gallons per minute (gpm), although yields of 15 gpm are the average. Alluvial deposits associated with abandoned river channels or detached terraces, will usually only yield as much as 20 gpm because they are topographically isolated and have limited saturation (Zelt et al. 1999).

TABLE 3-11.
2005 GROUNDWATER WITHDRAWALS FOR COUNTIES IN THE PLANNING AREA

County	Millions of Gallons per Day								
	Public Supply	Domestic	Industrial	Irrigation	Livestock	Aquaculture	Mining	Thermo-electric	Total
Big Horn	0.27	0.52	0.01	4.12	1.10	0.00	1.83	0.00	7.85
Carter	0.08	0.06	0.00	1.06	0.04	0.00	0.04	0.00	1.28
Custer	0.01	0.18	0.04	0.80	0.25	0.01	0.00	0.00	1.29
Daniels	0.21	0.06	0.03	0.88	0.25	0.00	0.00	0.00	1.43
Dawson	0.61	0.17	0.05	0.25	0.20	0.00	0.26	0.00	1.54
Fallon	0.41	0.07	0.04	0.71	0.01	0.00	0.03	0.00	1.27
Garfield	0.04	0.07	0.00	0.36	0.26	0.00	0.00	0.00	0.73
McCone	0.09	0.09	0.03	0.01	0.35	0.00	0.00	0.00	0.57
Powder River	0.14	0.10	0.00	0.17	0.85	0.00	0.00	0.00	1.26
Prairie	0.01	0.08	0.00	1.11	0.16	0.00	0.00	0.00	1.36
Richland	1.09	0.27	0.01	1.67	0.18	0.00	0.00	0.00	3.22
Roosevelt	0.44	0.42	0.04	2.20	0.10	0.00	0.01	0.00	3.21
Rosebud	0.71	0.09	0.08	1.27	0.36	0.00	0.09	0.10	2.70
Sheridan	0.31	0.09	0.06	9.28	0.10	0.00	0.11	0.00	9.95
Treasure	0.00	0.03	0.00	0.92	0.01	0.00	0.00	0.00	0.96
Valley	0.34	0.09	0.11	4.14	0.45	0.00	0.01	0.00	5.14
Wibaux	0.06	0.03	0.00	0.03	0.11	0.00	0.00	0.00	0.23
Total	**7.36**	**4.11**	**1.19**	**37.63**	**5.81**	**0.01**	**2.59**	**0.1**	**58.8**

Source: USGS 2005

**TABLE 3-12.
GROUNDWATER WELLS BY TOTAL DEPTH IN EASTERN MONTANA**

Depth (feet)	Number of Wells	Percentage of Total Wells (%)
0 to 99	16,644	44
100 to 199	9,526	25
200 to 299	4,136	11
300 to 399	1,948	5
400 to 499	953	3
500 to 599	597	2
600 to 699	380	1
700 to 799	296	<1
800 to 899	261	<1
900 to 999	210	<1
Greater than 1,000	547	2
Unknown	1,958	5

Source: MBMG 2009

The primary lower Tertiary (Cenozoic) aquifers include the Wasatch and Fort Union formation sandstones, clinker deposits, and coal beds. The Lebo member of the Fort Union formation functions as a confining layer and may yield water locally in areas in which sufficient thicknesses of channel deposits occur (Zelt et al. 1999). Clinker zones, which have a high permeability, are spring sources. These burned coal beds are typically unsaturated but form local aquifers where they occur below the water table. Overlying, fractured sandstones are a source of recharge (Miller 1999). The Wyodak and Wyodak Rider coal zone and the Anderson, Canyon, Big George, and Smith coals compose a regional aquifer with limited recharge at outcrops. The coal beds act as isolated aquifers and some flow occurs along faults and fractures (NAS 2010). Water within the lower Tertiary aquifers is commonly unconfined but can be confined by clay beds or glacial deposits. Flow trends northward and northeastward with discharge to the Yellowstone and Missouri rivers (Miller 1999). The Wasatch formation can be up to 1,000 feet thick (Miller 1999). Wells within the Fort Union formation aquifers are typically 100 to 200 feet deep but can be up to 1,500 feet in depth. These wells may produce as much as 40 gpm but yields of 15 gpm are more typical. In areas in which aquifers are confined and artesian conditions exist, wells in the Fort Union formation will generally flow less than 10 gpm.

The primary upper Cretaceous (Mesozoic) aquifers are the Cretaceous Hell Creek formation sandstones, Lance formation sandstones, and Fox Hills sandstone. The Lance and the Hell Creek formations range in thickness from approximately 350 to 3,400 feet and consist of interbedded sandstone, siltstone, claystone, coal, and lignite. The underlying Fox Hills sandstone ranges from approximately 300 to 450 feet thick. Flow trends north to northeast. Conditions are generally unconfined and aquifers discharge to major streams (Miller 1999). Well depths in Hell Creek and Fox Hills formation aquifers are highly variable but typically range from 200 to 1,000 feet in depth. Groundwater yields from these aquifers may be as much as 200 gpm but are generally less than 100 gpm. Artesian wells within these aquifers may flow as high as 20 gpm (Zelt et al. 1999).

The lower Cretaceous-Jurassic (Mesozoic) aquifers are separated from the upper Cretaceous aquifers by the confining Pierre and Lewis shales. The principal aquifers are the Muddy sandstone, Newcastle sandstone, Inyan Kara Group, and the Fuson and Lakota formations. The Sundance, Swift, Rierdon, and Piper formations yield water locally to wells. Because of the overlying confining unit, the lower Cretaceous-Jurassic (Mesozoic) aquifers generally do not discharge to streams (except locally). Water quality ranges from 1,000 to over 10,000 mg/L TDS (Miller 1999).

Water wells are rarely completed in the upper and lower Paleozoic aquifers because they are deeply buried and contain little freshwater. Upper Paleozoic aquifers consist primarily of the Madison Limestone or Madison Group. Locally, flow trends inward from all directions toward potentiometric depressions in eastern Montana. The depressions are possibly the result of the production of oil and gas from deeper strata. Withdrawal of oil and gas can allow water to leak downward from the upper Paleozoic aquifers through confining units (Miller 1999).

Groundwater yields from the deeper Paleozoic Madison formation aquifer can range from 1 to 100 gpm to even higher in karst areas (Noble, Bergantino, Patton, Sholes, Daniel, and Schofield 1982; Zelt et al. 1999). The well depth ranges from 500 to over 7,000 feet (BLM 2008g). Water quality of this aquifer is highly variable and TDS can be greater than 300,000 mg/L (Miller 1999). Lower Paleozoic aquifers consist of Ordovician to

Cambrian sandstone and carbonate rocks. Flow trends generally move northeastward toward the deep parts of the Williston Basin, but some flow leaks upward and discharges to springs, lakes, and streams in eastern North Dakota. Water quality of this aquifer is highly variable and TDS can be greater than 100,000 mg/L (Miller 1999).

WATER RIGHTS AND GROUNDWATER AQUIFER CONTROL AREAS

Water rights in Montana are subject to Montana's Water Use Act (85-2-101 et seq. Montana Code Annotated [MCA]) of 1973, which became effective July 1, 1973. Water rights existing prior to that date are finalized by state courts. Water rights applications submitted after that date will be evaluated through the Montana Department of Natural Resources and Conservation (MDNRC) permit system. In 2005, the Montana Legislature passed House Bill 22 to expedite water right claims examination and issuance of water right decrees and requires that the adjudication be completed by 2020.

Water rights on some BLM-administered lands are protected by the *Federally Reserved Water Rights for Public Springs and Water Holes*, *Public Water Reserve 107*, pursuant to the Executive Order dated April 17, 1926. Compacts between the State of Montana and the Northern Cheyenne Tribe have placed a moratorium on new water use developments on tribal lands within the Rosebud, Lower Bighorn, and Pryor watersheds. Water rights are adjudicated on an individual watershed basis. As of December 2010, Rosebud Creek and Yellowstone River (below the Powder River) were 78.43 and 41.1 percent examined, respectively (MDNRC 2010b). The Redwater River, Powder River (below Clear Creek), O'Fallon Creek, Little Missouri River (below Little Beaver Creek), Little Powder River, and Belle Fourche River (above the Cheyenne River) have been issued a final decree. A preliminary or temporary preliminary decree is issued for the other basins with the planning area (MDNRC 2010b). The Tongue River, Little Bighorn River, Rosebud Creek (78 percent examined), and lower Yellowstone River (90 percent examined) are not yet fully adjudicated (MDNRC 2010d).

In 1967, pursuant to section 89-2914 R.C.M. (Revised Code of Montana), 1947, a petition was granted to create the Short Pine Controlled Groundwater Area in portions of Fallon, Prairie, and Wibaux counties (Map 52). In this area, no new appropriations of groundwater may be made except by permit request (regardless of size), no presently inactive well may be used except with the approval of MDNRC, and no presently active well may increase its flow rate except with the approval of MDNRC. This controlled groundwater area was created to protect the interests of local groundwater users in response to increased groundwater withdrawals by the Shell Oil Company.

In 1999, the MDNRC established the Powder River Basin Controlled Groundwater Area in anticipation of the withdrawal of groundwater associated with coal bed natural gas (CBNG) development (this applies to CBNG wells completed above the Lebo member of the Fort Union formation). In this area, CBNG development must follow the standards for drilling, completing, testing, and production of CBNG wells as adopted by the Montana Board of Oil and Gas Conservation (MBOGC), and the MDNRC has the authority to designate a Technical Advisory Committee to oversee groundwater characteristics and monitoring and reporting requirements. Within the area, CBNG operators must offer water mitigation agreements to owners of water wells and natural springs located within 0.5 miles of a CBNG field or within the area that the operator reasonably believes may be affected by a CBNG production operation, whichever is greater, and automatically extends 0.5 miles beyond any well adversely affected. Any beneficial use of CBNG-produced water requires water rights issued by the MDNRC, as established by law.

Within the planning area, two basins were closed to protect Tribal Water Rights under the Northern Cheyenne (MCA 85-20-301) and Fort Belknap Compact (MCA 85-20-100) closures in 1991 and 2001, respectively. In these areas, an approved Application for Beneficial Water Use Permit is required and the applicant is subject to the requirements of 85-2-360, 85-2-361, and 85-2-362 Montana Code Annotated (MCA) for any water appropriation. The Northern Cheyenne-Montana Compact includes all of Rosebud Creek basin from its headwaters to its confluence with the Yellowstone River, in Big Horn and Rosebud counties. Fort Belknap-Montana Compact closure includes the Beaver Creek, Milk River, Missouri River, and Peoples Creek basins.

COAL BED NATURAL GAS

The potential effects on groundwater and surface water quantity and quality are caused by groundwater abstraction and drawdown concurrent with CBNG production and CBNG-produced water management and storage (NAS 2010). In January 2003, the BLM and State of Montana, anticipating an increase in CBNG development, published the *Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment for the Powder River and Billings Resource Management Plans* (BLM, MBOGC, and MDEQ 2003). This environmental impact statement (EIS) analyzed various approaches for managing oil and gas resources statewide, with an emphasis on the Billings and Powder River RMP areas. This Final EIS and the BLM's 2008 *Record of Decision for the Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans* set management goals, addressed resource issues and concerns, established monitoring plans, and provided detailed reports on groundwater and surface water issues related to CBNG development. Refer to this document for a detailed analysis of CBNG development in the Powder River RMP area.

CBNG occurs in coal beds primarily within the Powder River Basin (PRB). Coal beds are the primary aquifers for agricultural communities in southeastern Montana. In many areas, the coal aquifers supply water for livestock, wildlife, and domestic use (BLM 2008f). When CBNG is developed, the methane must be desorbed from the coal so that it can flow to production wells; this is typically achieved by pumping groundwater from the coal bed aquifer, which promotes methane desorption by creating a pressure gradient within the aquifer that enables methane to flow towards the well. Because coal beds within PRB have a high porosity and permeability, the volume of groundwater withdrawn by the CBNG production is larger than in other basins. Groundwater is considered a nonrenewable resource if it would not be recharged within a human lifetime. Preliminary data shows that some CBNG-produced water is at least 14,000 years old even within a few miles of recharge areas. Water is younger near recharge sites and is older in the center of the PRB (NAS 2010).

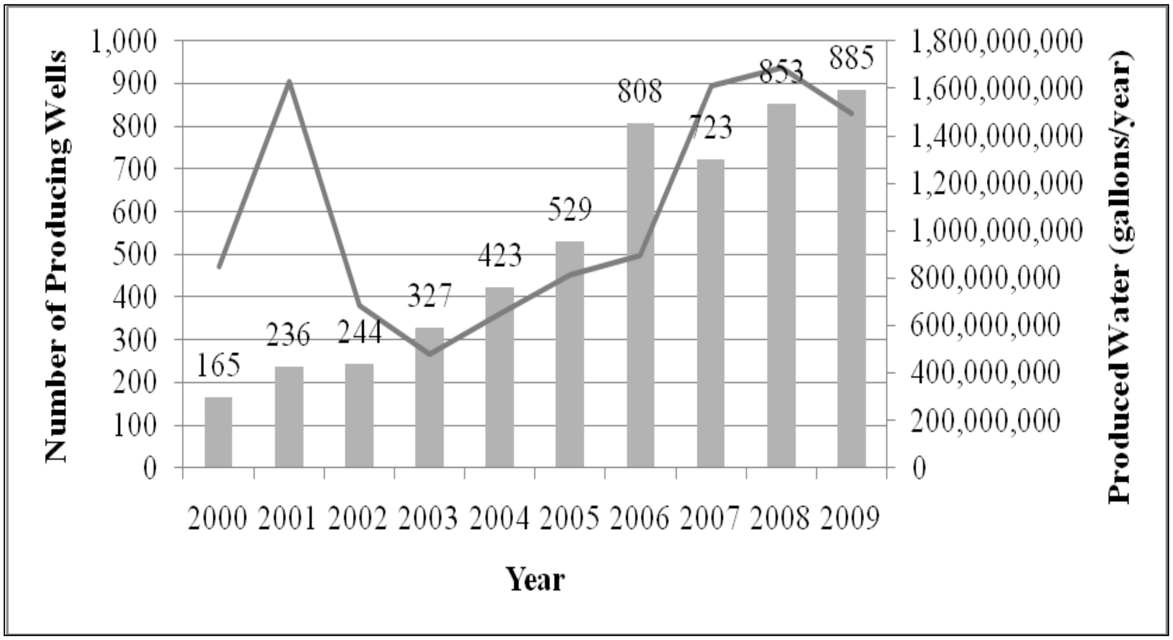
The connectivity of developed coal beds, surrounding aquifers, and surface water affects the ways in which water flows, recharges, and is affected by water withdrawal. Within the PRB, any drawdown that occurs within the developed coal seam would primarily affect that coal seam and would not noticeably affect overlying or underlying formations. The coals within the Tongue River member of the Fort Union formation are typically bound by clay-rich strata, and the vertical hydraulic conductivity above and below these units are very low (Wheaton and Donato 2004). Wheaton and Metesh (2002) have noted that "based on conditions near Decker, vertical leakage from units near ground surface is thought not to be a major factor. There, drawdowns in coal beds pass uninterrupted beneath perennial streams (Squirrel Creek and the Tongue River) and the associated alluvial valley floors. Water-table levels in the alluvium and a shallow sandstone unit have not responded to coal-mine induced drawdown"(p. 41).

The volume of water pumped from CBNG wells generally decreases exponentially with time, with a corresponding increase in the rate of methane production. The amount of water produced varies from well to well. Annual water production is also variable (Figure 3-8). Based upon historical data from the CX field, initial water production rates are anticipated to be approximately 5 gpm per produced coal seam. The rate of water production per well decreases over time as the pressure within the aquifer is reduced over an increasing geographic area; a 20 percent decline rate per year is typical (BLM 2008f). As wells operate over time, hydrostatic pressure drawdown occurs within the coal aquifer. For example, in the Canyon coal bed, the hydrostatic pressure has been lowered more than 600 feet, and, in the Dietz and Canyon beds, a 20-foot groundwater drawdown extended about 1.0 to 1.5 miles beyond the boundary of the CX field after nearly 9 years of CBNG production. Wheaton, Reddish-Kuzara, Meredith, and Donato (2008) found that "These values have not changed substantially since 2004. These distances are similar to but somewhat less than predicted in the Montana CBM [coal bed methane or CBNG] environmental impact statement" (p. 67).

The quality of PRB CBNG-produced water varies, but it is generally characterized by elevated levels of salinity, SARs (36.8 to 66.3), and TDS (up to 2,029 mg/L) (Wheaton e al. 2008). It is characterized by sodium bicarbonate type water (NAS 2010). EC and SAR are primary constituents of concern with CBNG discharges. SAR, which is a complex ratio of sodium to calcium and magnesium, is an important parameter for determining the utility of water for irrigation because it has the potential to impact clay-rich soils (see the *Soils Appendix*).

EC and SAR are the primary factors that determine the usability of water for irrigation, and irrigation is the use that has been determined to be most sensitive to CBNG inputs (BLM 2008f). Organic constituents such as phenols, biphenyls, heterocyclic compounds, and polycyclic aromatic hydrocarbons are present in some produced waters. Polycyclic aromatic hydrocarbons are the most common organic substance in the PRB (NAS 2010).

FIGURE 3-8.
CUMULATIVE COAL BED GROUNDWATER PRODUCTION FOR ALL FIELDS IN MONTANA WITHIN THE POWDER RIVER BASIN



Annual data for 2008 and 2009 reflects the water year (October 1 to September 30)

The Montana Board of Environmental Review established surface water standards for EC and SAR in 2003. These numerical standards have been reviewed and approved by the USEPA, and therefore have standing under the Clean Water Act. In 2006, the Board modified the standards for EC and SAR. The most substantial changes adopted by the Board were to designate EC and SAR as “harmful” parameters, and to remove the requirement that permitting in relation to EC and SAR be flow based (BLM 2008f).

The Northern Cheyenne Tribe adopted surface water quality standards for EC and SAR in 2001. Although the Northern Cheyenne Tribe has been granted “Treatment as a State” status by the USEPA, the USEPA has not approved their standards. As such, the Northern Cheyenne numerical standards do not have standing under the Clean Water Act. These standards outline the Tribe’s considered determination of the water quality needed to protect irrigated agriculture on the Reservation and native plant species with cultural significance integral in ceremonial and traditional areas. Therefore, the Northern Cheyenne standards provide reasonable criteria against which to compare the resulting water quality. The Northern Cheyenne’s non-degradation criteria apply to all numerical standards (non-degradation criteria do not apply in-stream, but rather serve as a trigger during the permitting process.). The Northern Cheyenne’s non-degradation requirements allow for a 5-percent increase in a parameter per permit, with the cumulative change being limited to the numerical standards. Monitoring data indicates that EC and SAR values in the Tongue River are typically less than the numerical standards. As such, some new or increased discharges that would increase in-stream EC or SAR could be approved under the Northern Cheyenne non-degradation criteria. If the Northern Cheyenne standards are approved by the USEPA under the Clean Water Act, both the numerical limits and the non-degradation criteria would need to be applied to upstream discharges. Although the Northern Cheyenne numerical standards are more stringent in their current form than the MDEQ numerical standards, the non-degradation criteria would be less stringent (Table 3-13) (BLM 2008f).

TABLE 3-13.
SURFACE WATER STANDARDS FOR THE TONGUE RIVER

Type of Standard	Monthly Mean SAR	Inst. Max SAR	Monthly Mean EC (µS/cm)	Inst. Max EC(µS/cm)
MDEQ Irrigation Season[1] Standards[2]	3	4.5	1,000	1,500
MDEQ Non-irrigation Season[1] Standards	5	7.5	1,500	2,500
Northern Cheyenne Irrigation Season[1] Standards, Southern Boundary	--	2	1,000	2,000
Northern Cheyenne Non-irrigation Season[1] Standards, Southern Boundary	--	2	--	2,000

Source: BLM 2008g
[1]The irrigation season specified by the MDEQ is from March 1 to October 31 while the irrigation season specified by the Northern Cheyenne is from April 1 to November 15.
[2]The irrigation season standards apply to the portion of the Tongue River between the state line and Tongue River Reservoir for the entire year.

In the PRB in Montana, CBNG-produced water is disposed by discharge, evaporation in lined or unlined surface impoundments, infiltration in unlined surface impoundments, injection, and beneficial use. Potential options for beneficial use include land-applied water spreading, managed surface irrigation, livestock and wildlife watering, subsurface drip irrigation, in-stream flow augmentation, wetlands augmentation, and industrial and municipal uses. Currently, 61 to 65 percent is directly discharged to streams, 4 to 5 percent is used for industrial dust control, 26 to 30 percent is used for irrigation (7 percent of which is underground injection control subsurface drip irrigation [horizontal injection]), and 5 percent is disposed of in surface impoundments (NAS 2010).

Comparison of specific conductance versus flow, SAR versus flow, and SAR versus specific conductance do not indicate a definitive difference between pre- and post-CBNG data for the Tongue River (Bobst 2008). Most monitoring data using SAR and TDS of the Powder and Tongue rivers show no change in surface water quality resulting from CBNG-produced water discharge. There is not enough data, (e.g., background streamflow, climatic conditions) to determine the effects of CBNG-produced water discharge on flows in streams and rivers in the PRB. "Other physical effects to ephemeral or perennial streams and rivers, such as bank scouring, increased bottom sedimentation, or channel erosion due to regulated, controlled, and managed, or unregulated and/or unmanaged CBM [coal bed methane or CBNG] produced water discharges have been registered on private lands in the Powder River and Raton basins" (NAS 2010, p. 185).

Initially, the majority of CBNG water was discharged untreated and unpermitted into surface waterways. Prior to 1998, the MDEQ authorized Fidelity Exploration to discharge CBNG water into the Tongue River without a permit if the ambient water quality was unaltered. However, because the USEPA notified the MDEQ that this was in violation of the Clean Water Act, Fidelity Exploration began discharging treated and untreated CBNG water authorized by two permits (MT-0030457 and MT-0030724) into the Tongue River in 2000 (BLM 2008g). These permits had specific water quality standards, and Fidelity is required to monitor discharged water quality on a daily basis, to ensure permit compliance. In May 2010, the Montana Supreme Court decision *Northern Cheyenne Tribe v. Montana Department of Environmental Quality* (234 P.3d 51) determined that the MDEQ violated the Clean Water Act and the Montana Water Quality Act (75-5-301 et seq. MCA) by issuing the permits without imposing treatment-technology-based effluent limits and declared the permits void. Beginning on November 14, 2010, the permit, which was reevaluated by the MDEQ, allows discharge of treated water only up to 1,700 gallons per minute to the Tongue River. Although the treated discharge permit (MT-0030724) allows for the discharge year round, the effluent limitations vary seasonally. During the winter, the average monthly SAR may not be in excess of 5.0 and the average monthly EC may not be in excess of 1,500 Siemens per centimeter (S/cm). During the spring and summer, the average monthly SAR may not be in excess of 3.0 and the average monthly EC may not be in excess of 1,000 S/cm.

Anion-exchange water treatment is the process Fidelity uses to treat produced water. This process produces a concentrated, low-pH NaCl brine (approximately 1 percent of the feed volume). This brine is neutralized onsite with lime to maintain a pH above 6 and is currently transported by Kissack Water and Oil Services, Inc., a licensed waste hauler. The brine is disposed of at Kissack's Kuehne injection well (operated under underground injection control permit #01-109), and Kissack's Hamm #1 injection well (operated under underground injection control permit 01-036) (BLM 2008f).

Summit Gas Resources, Inc. (formerly Pinnacle Gas Resources, Inc.) has applied to renew permit MT-0030660 which allowed discharge of up to 1,122 gpm (1.6 million gallons per day) of treated CBNG water to be discharged downstream of the Tongue River Reservoir. The treatment facility operated during March 2005 to April 2007 using ion exchange technology. For the renewal, in addition to previous limitations, new effluent limitations would be total nitrogen and phosphorous. Biological monitoring would no longer be required (MDEQ 2011).

Within Wyoming, two permits were originally issued in 1999 that allowed for the direct discharge of untreated CBNG water to surface waters in the Tongue River watershed. Both permits were renewed in April of 2004. Currently, these permits authorize the discharge of 135 gpm from 11 discharge points to Goose Creek, and 40 gpm from three discharge points to the Tongue River. More recently, the "Brinkerhoff" permits were issued in the Prairie Dog Creek watershed for discharge of untreated water into impoundments. A permit for the discharge of up to 600 gpm of treated water into Prairie Dog Creek has also been approved by the WDEQ. This permit establishes a dissolved sodium effluent limit of 50 mg/L and an EC effluent limit of 1,000 µS/cm. Within the Wyoming portion of Hanging Woman Creek, there is a Wyoming pollutant discharge elimination system permit for the discharge of untreated CBNG water to 13 off-channel impoundments (WY0053023), and a Wyoming pollutant discharge elimination system permit for the discharge of untreated CBNG water to one on-channel impoundment (WY0052407) (BLM 2008f).

HISTORIC AND FUTURE TRENDS IN CLIMATE AND HYDROLOGY

Climate change will continue to alter the water cycle through changes in precipitation timing, type, amount, and distribution; changes in drought; increases in evaporation rates and atmospheric water vapor; melting snow and ice; increases in water temperature; and changes in soil moisture and overland flow. Atmospheric water vapor is an important and abundant greenhouse gas (Karl et al. 2009). Although anthropogenic sources of water vapor (including irrigation, impoundments, combustion) provide a small increase in atmospheric water, climate warming increases the amount of water vapor in the atmosphere through warmer temperatures that increase relative humidity and evaporation rates (Karl et al. 2009). Increased atmospheric water further increases surface temperatures and can contribute to changes in seasonal precipitation (Karl et al. 2009).

Over the 20th century, the average temperature has increased approximately 2 °F within the Missouri River basin; within Montana, upward trends in average annual minimum and maximum temperatures have been observed. Mean annual precipitation within the Missouri River basin has fluctuated over this period and there is no conclusive trend with respect to relative annual temperature (USBOR 2011). Over the past century, warmer spring temperatures have led to peak runoff dates 10 to 15 days earlier for the upper Yellowstone River at Corwin Springs, Montana (USGS 2012). Increasing standard deviations of mean annual streamflows over the 20th century show increasing interannual variability and therefore increasing frequency of extreme stream flows and flood events (Wagner 2003). There have been increasing trends (1958 to 2007) in end-of-summer drought as measured by the Palmer Drought Severity Index (Karl et al. 2009).

The upper Missouri River basin average mean annual temperature is expected to increase approximately 5 °F during the 21st century (USBOR 2011). Over the 21st century, mean-annual precipitation is expected to increase with a change in precipitation seasonality (USBOR 2011). Prediction of future precipitation changes from the recent past to 2080 to 2099 indicate that precipitation in the planning area will increase 15 to 20 percent in winter and spring and decrease no more than 5 percent in summer. During fall, precipitation in the northern part of the planning area will increase by up to 5 percent while the southern portion of the planning area will experience a 0- to 5-percent decrease (Karl et al. 2009). A change in seasonality of streamflow with increased winter flows, reduced magnitude and earlier spring peak flows, and reduced summer and fall flows are predicted. Additionally, with increases in annual precipitation, total annual flows could increase if higher temperatures do not negate this change through higher evapotranspiration rates (Wagner 2003).

In addition to changes in precipitation, warming is expected to reduce snowpack and increase rainfall runoff during the cool season (USBOR 2011). Warmer winters would increase sublimation and reduce snowpack (Johnson et al. 2010). It is projected that December to March runoff will increase and April to July runoff will decrease. An increase in warming and reduced summer precipitation will increase evaporative losses of water resources to the atmosphere (USBOR 2011). An increase in extreme rainfall events and drought events is expected (Karl et al. 2009) however; further studies are needed to predict the magnitude of these events (USBOR 2011).

Increases in air temperature will lead to increases in water temperature and changes in water quality. Dissolved oxygen levels will be reduced at higher water temperatures. Increased heavy precipitation events will lead to increased erosion and sedimentation (Karl et al. 2009). Climate change is projected to affect the capacity of surface water ecosystems to remove pollutants and improve water quality (USBOR 2011). The USEPA predicts that the number of waterbodies listed as impaired will increase (Karl et al. 2009). It is likely that a warmer climate (and changes in precipitation seasonality to a lesser degree) will lead to fewer, shorter duration wetlands in the Missouri River basin (USBOR 2011).

Groundwater resources may be impacted by reduced snowpack, earlier snowmelt, and reduced spring and summer flows through reduced recharge; however, warmer, wetter winters may increase recharge rates for this season (Wagner 2003) as well as increased flooding events. Changes in vegetation and soils would alter evaporation, erosion, and infiltration rates (Karl et al. 2009). Beneficial use demands (including agriculture) on water resources may change as a result of changing hydrology, temperatures, atmospheric carbon dioxide levels, ozone levels, and increased evaporative losses (Wagner 2003).

VEGETATION

Classification descriptions from the Montana Natural Heritage Program (MNHP) Montana Field Guide were used (MFWP and MNHP 2012).

The planning area includes six general land classes or vegetative communities: agriculture or urban areas, grassland, shrubland, forests (described under *Forestry and Woodland Products*), riparian areas (described under *Riparian and Wetland Areas*), and barren lands. Non-riparian wetlands are also present; however, these are not defined separately because they are widespread and generally present in relatively small areal units compared to other land classes. All of these habitats are important to a wide variety of wildlife species. See *Forestry and Woodland Products* for more information on vegetation in the planning area.

Plant Communities

Grasslands

Soil nutrient retention and fast biological recycling cause grasslands to rank among the most biologically productive of all vegetative communities. They are also very valuable because the vegetation is nutritious and used by livestock and wildlife (Williams and Diebel 1996; Estes, Tyrl, and Brunken 1982). Grassland sites are dominated by herbaceous canopy cover at greater than 15 percent, shrub cover at less than 15 percent, and forest cover at less than 10 percent (Fisher et al. 1998).

Grasslands cover an estimated 3.6 million BLM-administered acres of the 17 counties that compose the planning area.

Shrublands

Shrublands are characterized by shrub covers greater than 15 percent and forest cover less than 10 percent (Fisher et al. 1998). This vegetation type is dominant on approximately 830,000 BLM-administered acres of the planning area. Important shrubs include several species of sagebrush (*Artemisia nova*, *A. tridentata* ssp. *tridentata*, *A. tridentata* ssp. *vaseyana*, and *A. cana* and *A. tridentata* ssp. *wyomingensis*) and shadscale

(*Atriplex confertifolia)* or fourwing saltbush (*Atriplex canescens*). Other important shrub species in this category are bitterbrush (*Purshia tridentata*), creeping juniper (*Juniperus horizontalis*), greasewood (*Sarcobatus* spp.), mountain mahogany (*Cercocarpus* spp.), rabbitbrush (*Chrysothamnus* spp.), and shadscale (*Atriplex canescens*). These shrublands are often associated with a complex of understory grasses such as bluebunch wheatgrass (*Elymus spicatus*), blue grama (*Bouteloua gracilis*), Idaho fescue (*Festuca idahoensis*), needle and thread (*Stipa comata*), and western wheatgrass (*Agropyron smithii*).

Barren Lands

These are sites with less than 10 percent forest cover, less than 10 percent shrub cover, and less than 10 percent herbaceous cover (Fisher et al. 1998).

Plant Species of Concern

Federally listed plant species have been designated as either threatened or endangered under the Endangered Species Act (ESA). In 2005, the MNHP did not report any federally listed plants present within the planning area. There are no known threatened or endangered plant species on public lands within the planning area. There are occurrences of BLM sensitive species, which are managed in cooperation with state and federal agencies.

BLM Sensitive Plant Species

The BLM's 6840 Manual, *Special Status Species Management*, gives the BLM State Director the responsibility of designating BLM Sensitive Species and periodically updating the list in cooperation with state government and natural heritage programs. The sensitive species classification recognizes that conservation actions are needed to preclude the species from listing and improve the status of species so special status recognition is no longer warranted.

Sensitive species are those species known to occur on BLM-administered lands (or lands affected by BLM-authorized actions) whose conservation status could be significantly affected by BLM management actions.

State Species of Concern

In addition to species that are federally protected under the ESA, the State of Montana has designated additional species of concern within its jurisdictional boundaries (Table 3-14). There are five rankings for State Species of Special Concern but this document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled due to extreme rarity (five or fewer occurrences or very few remaining individuals) or because some factor of its biology make it especially vulnerable to extinction.

Blacksampson echinacea or narrow-leaved purple coneflower (*Echinacea angustifolia*) near Tenmile Creek

TABLE 3-14.
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Counties of Known Occurrence	Classification MT	Classification BLM[1]
Lead plant	*Amorpha canescens*	Carter and Rosebud	SH	S
Ovalleaf milkweed	*Asclepias ovalifolia*	Carter	S1	
Narrowleaf milkweed	*Asclepias stenophylla*	Carter and Rosebud	S1	S
Sweetwater milkvetch	*Astragulus aretioides*	Big Horn	S2	S
Barr's milkvetch	*Astragulus barrii*	Big Horn, Carter, Powder River, and Rosebud	S2S3	S
Geyer's milkvetch	*Astragulus geyeri*	Garfield	S2	S
Raceme milkvetch	*Astragalus racemosus*	Carter and Fallon	S2S3	
Roundleaf water-hyssop	*Bacopa rotundifolia*	Garfield	S1S3	
Crawe's Sedge	*Carex crawei*	Prairie	S2	S
Pregnant sedge	*Carex gravida var. gravida*	Big Horn, Powder River, and Rosebud	S1	
New Jersey tea	*Ceanothus herbaceous*	Powder River	SH	
Alderleaf mountain-mahogany	*Cercocarpus montanus var. glaber*	Treasure	S1S2	
Smooth goosefoot	*Chenopodium subglabrum*	Carter, Custer, and Powder River	S1	
Wyoming thistle	*Cirsium pulcherrimum*	Powder River	S1	
Yellow bee plant	*Cleome lutea*	Big Horn	S1	S
Schweinitz' flatsedge	*Cyperus schweinitzii*	Prairie and Carter	S2	S
Nine-anther prairie clover	*Dalea enneandra*	Custer	S1	
Silky prairie clover	*Dalea villosa var. villosa*	Carter	S1	
Scribner's panic grass	*Dichanthelium oligosanthes var.*	Powder River	S1	
Big Horn fleabane	*Erigeron allocotus*	Big Horn	S3	
Visher's buckwheat	*Eriogonum visheri*	Carter	S1	S
Spotted joepye-weed	*Eupatorium maculatum*	Big Horn	S1S2	
Spiny hopsage	*Grayia spinosa*	Big Horn	S2	S
Bush morning-glory	*Ipomoea leptophylla*	Big Horn, Rosebud, and Treasure	S1S2	
Pale-spiked lobelia	*Lobelia spicata*	Dawson and Richland	S2	S
Nuttall's desert parsley	*Lomatium nuttallii*	Big Horn and Rosebud	S1	S
Bractless blazingstar	*Mentzelia nuda*	Custer, Powder River, Roosevelt, and Rosebud	S1S2	S
Blue toadflax	*Nuttallanthus texanus*	Carter, Dawson	S1	S
Little indian breadroot	*Pediomelum hypogaeum*	Carter, Powder River, and Rosebud	S2S3	S
Narrowleaf penstemon	*Penstemon angustifolius*	Carter	S2	S
Large flowered beardtongue	*Penstemon grandiflorus*	Custer	S1	
Hot spring phacelia	*Phacelia thermalis*	Garfield	S1	S
Plains phlox	*Phlox andicola*	Carter, Powder River, and Rosebud	S2	S
Double bladderpod	*Physaria brassicoides*	Carter, Custer and Powder River	S2	S
Woolly twinpod	*Physaria didymocarpa var. lanata*	Big Horn and Rosebud	S1	S
Silver bladderpod	*Physaria ludoviciana*	Carter and Fallon	S2S3	
Slender-branched popcorn-flower	*Plagiobothrys leptocladus*	Custer	S1	
Sand cherry	*Prunus pumila*	Fallon	S1	S
Dwarf woolly-heads	*Psilocarphus brevissimus*	Rosebud	S2	S
Bur oak	*Quercus macrocarpa*	Carter	S1	S
Persistent-sepal yellow-cress	*Rorippa calycina*	Big Horn, Custer, Rosebud, and Treasure	S1	S
Desert groundsel	*Senecio gremophilus*	Big Horn	S1S2	
Prairie aster	*Solidago ptarmicoides*	Carter	S1	
Rock-tansy	*Sphaeromeria capitata*	Big Horn	S3	
Slender wedgegrass	*Sphenopholis intermedia*	Big Horn	S1	
Letterman's needlegrass	*Stipa lettermanii*	Big Horn	S1	
Poison suckleya	*Suckleya suckleyana*	Dawson and Roosevelt	S1	S
Wyoming sullivantia	*Sullivantia hapemanii*	Big Horn	S2	
Soft aster	*Symphyotrichum molle*	Big Horn	S1S3	
Nannyberry	*Viburnum lentago*	Big Horn, Richland	S1	S

Source: BLM 2008g. [1]If blank, then it does not occur on BLM-administered lands. S: sensitive. S1: At risk because of extremely limited or rapidly declining numbers, range and or habitat, making it highly vulnerable to extirpation in the state. S2: At risk because of very limited or declining numbers, range or habitat, making it vulnerable to extirpation in the state. S3: At risk because of very limited or declining numbers, range or habitat, making it vulnerable to extirpation in the state. SH: Possibly extinct-species known from only historical occurrences, but may nevertheless still be extant, further searching is needed.

Sensitive species are those species documented on BLM-administered land and determined, through review with the BLM and MNHP, to be rare or imperiled.

Climate change also poses challenges for many resource uses on BLM-administered land. Drought and evaporation may reduce seasonal water supplies, which in turn reduces the growth and vigor of special status plants and species of concern. However, in non-drought years, longer growing seasons resulting from thermal increases may increase vegetative growth and vigor throughout the year for special status plants and species of concern.

RIPARIAN AND WETLAND AREAS

Literature defines riparian and wetland areas as those saturated or inundated at a frequency and duration sufficient to produce vegetation typically adapted for life in saturated soil conditions. These areas are also transitional areas between permanently saturated wetlands and upland areas often referred to as riparian areas; these transition areas have vegetation or physical characteristics reflective of permanent surface or subsurface water influence (Prichard et al. 1999).

Riparian and wetland areas may be associated with lakes, reservoirs, estuaries, potholes, springs, bogs, and wet meadows as well as ephemeral, intermittent, or perennial streams. Within wetlands, riparian areas are those areas geographically delineated by distinctive resource values and characteristics composing aquatic and riparian ecosystems. Perennial streams flow continuously and are generally associated with a water table in the localities through which they flow. Intermittent streams flow only at certain times of the year when the area receives water from springs or some surface source (such as melting snow or rain events). Ephemeral streams flow only in direct response to precipitation because the associated channels are above the water table. Intermittent and ephemeral streams are not classified separately for riparian areas until assessments have been conducted for each stream reach.

Riparian and wetland areas are assessed based on their potential and capability (Table 3-15). A potential riparian and wetland area is defined as the highest ecological status a riparian or wetland area can attain given no political, social, or economic constraints. These areas are often referred to as the potential natural community (Prichard et al. 1999). Capability is defined as the highest ecological status an area can attain given political, social, or economic constraints (often referred to as limiting factors) (Prichard et al. 1999). Within the planning area, there are 15,166 miles of potential riparian and wetland areas that are not currently assessed for functioning condition and functional rating.

TABLE 3-15.
RIPARIAN STREAM CLASSIFICATION FOR THE PLANNING AREA[1]

Stream Classification	Miles	Percentage of Total (%)
Perennial	122	15
Intermittent	232	28
Ephemeral	259	31
Unknown[2]	220	26

[1]Based on the 833 total miles assessed
[2]Assessment of historical data with no data collected.

PFC is a qualitative method for assessing the conditions of riparian and wetland areas. It involves a consistent approach for assessing hydrology, riparian vegetation, soils, physical state, and processes to determine the overall condition or health of riparian and wetland areas. Changes are necessary to allow recovery in areas that do not meet PFC. Based on a tiered classification system, individual sites are assessed and placed into categorized functional ratings. PFC is attained when physical and biological attributes and processes of riparian and wetlands are in balance with the landscape. Functional-at risk refers to properly functioning riparian and wetland systems with attributes that increase susceptibility to degradation. This rating can also reflect the trend classifications downward, upward, or static. A nonfunctional classification refers to riparian and wetlands with key vegetation, hydrologic, soil, or other physical deficiencies that renders them incapable of providing adequate vegetation, landform, or woody debris to dissipate energies associated with flow events (and subsequently reduce erosion or improve water quality). Non-riparian refers to the areas lacking the key riparian vegetation, hydrological, or soil components. However, these areas develop woody vegetation and may be classified as hardwood draws. In the planning area, 833 miles of riparian areas have been assessed for functioning condition and functional rating (Table 3-16 and Maps 53 and 54).

TABLE 3-16.
RIPARIAN STREAM FUNCTIONAL RATING FOR THE PLANNING AREA

Functioning Rating	Miles	Percentage of Total (%)
PFC	332	56
Functional-at risk	235	40
Functional-at risk with downward trend	45	8
Functional-at risk with upward trend	53	9
Functional-at risk with static trend	68	11
Functional-at risk, not apparent	69	12
Nonfunctional	25	4
Non-riparian	241	0

Within the planning area, nonfunctional and functional-at risk riparian areas generally do not meet PFC condition because of hydrology, vegetation, or erosion or deposition functions. The most common factors contributing to the failure to meet PFC conditions include imbalanced width and depth sinuosity ratio, lack of diverse age-class distribution and composition of riparian and wetland vegetation, vertically unstable systems, and point bars that lack riparian and wetland vegetation. Each nonfunctional or functional-at risk reach either contains all factors or only a few factors that decline overall condition.

Riparian and wetland areas combine water, increased vegetation, shade, and a favorable microclimate to create the most biologically diverse habitat found on BLM-administered lands. Riparian and wetland areas contribute factors to recreational values, fish and wildlife, water supply, and cultural and historic values as well as economic values related to livestock production, timber harvest, and mineral extraction. Climate change effects will be monitored and inspected within riparian and wetland plant communities during Rangeland Health Standard surveys for proper functionality.

PROPOSED CARTER MASTER LEASING PLAN AREA

An area in Carter County has been identified for an oil and gas MLP (see *Oil and Gas* for more information on MLPs). The Carter MLP area contains riparian areas overlying areas with oil and gas development potential (Table 3-17).

TABLE 3-17.
BLM-ADMINISTERED RIPARIAN ACRES WITH OIL AND GAS DEVELOPMENT POTENTIAL IN THE PROPOSED CARTER MASTER LEASING PLAN AREA

Type of Acres	Acres of Riparian Areas
High Oil and Gas Development Potential Surface Acres	200
High Oil and Gas Development Potential Mineral Acres	1,800
Medium Oil and Gas Development Potential Surface Acres	2,800
Medium Oil and Gas Development Potential Mineral Acres	7,300
Low Oil and Gas Development Potential Surface Acres	2,900
Low Oil and Gas Development Potential Mineral Acres	7,300

INVASIVE SPECIES

The BLM works cooperatively with the State of Montana and the Custer, Prairie, Carter, Garfield, Richland, and Dawson county weed control districts to conserve and enhance all resources within the planning area. The Animal and Plant Health Inspection Service is currently a cooperator with the BLM for pest control. The MCFO is responsible for all aspects of control management, monitoring, and evaluation.

Invasive, nonnative plant species are not indigenous to the planning area and spread readily into healthy native plant communities. Typically, invasive plant species are detrimental to native ecosystems and human welfare. Invasive species are undesirable native or nonnative plants that have either been designated by the State of Montana or declared as such by the county weed control districts. For the purpose of this discussion, nonnative invasive species are a subset of invasive plant species. With the exception of vascular plants classified as invasive plant species, a pest can be any biological life form that poses a threat

TABLE 3-18.
MONTANA NOXIOUS WEED LIST

Category	Weed
Priority 1A	Yellow starthistle
Priority 1B	Dyer's woad (*Isatis tinctoria*) Flowering rush (*Butomus umbellatus*) Japanese knotweed complex (*Polygonum spp*.) Rush skeletonweed (*Chondrilla juncea*) Eurasian watermilfoil (*Myriphyllum spicatum*) Scotch broom (*Cytisus scoparius*) Curlyleaf pondweed (*Potamogeton crispus*)
Priority 2A	Tansy ragwort (*Senecio jacobea L.*) Meadow hawkweed complex (*Hieracium patense, H. floribundum, and H. piloselloides*) Orange hawkweed (*Hieracium aurantiacum L.*) Tall buttercup (*Ranunculus acris L.*) Perennial pepperweed (*Centaurea repens*) Yellowflag iris (*Iris pseudacorus*) Blueweed (*Echium vulgare*) Hoary alyssum (*Berteroa incana*)
Priority 2B	Canada thistle (*Cirsium arvense*) Field bindweed (*Convolvulus arvensis*) Leafy spurge (*Euphorbia esula*) Whitetop (*Cardaria draba*) Russian knapweed (*Centaurea repens*) Spotted knapweed (*Centaurea maculosa*) Diffuse knapweed (*Centaurea diffusa*) Dalmatian toadflax (*Linaria dalmatica*) St. Johnswort (*Hypericum perforatum*) Sulfur (Erect) cinquefoil (*Potentilla recta*) Common tansy (*Tanacetum vulgare*) Oxeye daisy (*Chrysanthemum leucanthemum L.)* Houndstongue (*Cynoglossum officinale L.)* Yellow toadflax (*Linaria vulgaris*) Salt-cedar (*Tamarix spp.)*
Priority 3	Cheatgrass (*Bromus tectorum*) Hydrilla (*Hydrilla verticillata*) Russian olive (*Elaeagnus angustifolia*)

Source: Montana Department of Agriculture 2010; List current as of September 2010

to human or ecological health and welfare.

There are 32 designated noxious weeds on the Montana Noxious Weed List (Table 3-18). Most species on the BLM's national list of invasive plant species have not invaded the planning area. Invasive plant species often outcompete native plant species and are considered a detriment to native vegetation. Invasion and spread of invasive plant species in the planning area has contributed to economic losses and the loss of rangeland productivity, reduced structural and species diversity, and degraded and fragmented wildlife habitat. Based on observations and reports by the county weed control districts, invasive plant species control measures are limiting population sizes in some cases. Inventory and monitoring for invasive plant species have been initiated, but currently the data are insufficient to project the rate or spread of invasive plant species in the planning area.

Historical invasive plant species infestations in the planning area likely began as small patches in disturbed areas because of development, fire, roadway and utility corridors, livestock concentration areas, recreation, or OHV trails. Fire and grazing are important disturbance factors that promote invasive plant species invasions. Although data are not available, the spread of initial infestations in the planning area are thought to have occurred through seed or other propagate transport to disturbed areas by wildlife, livestock, vehicles, people, water, or wind. Along the southeastern and central portion of Montana, where historical land uses have included grazing, agriculture, and energy and mineral development, disturbed areas have become more frequent and vegetative communities fragmented.

Species on the Montana Noxious Weed are categorized below.

- Priority 1A invasive species are not present in Montana. Management criteria will require eradication if detected, including education and prevention.
- Priority 1B invasive species have a limited presence in Montana. Management criteria will require eradication or containment and education.
- Priority 2A invasive species are common in isolated areas of Montana. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local

weed districts.

- Priority 2B invasive species are abundant in Montana and widespread in many counties. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts.
- Priority 3 Regulated Plants (not listed as Montana noxious weeds) have the potential to have significant negative impacts. The plant may not be intentionally spread or sold, other than as a contaminant in agricultural products. The state recommends research, education, and prevention to minimize the spread of the regulated plant.

Changes in vegetative frequency; construction of roads, utility corridors, and well pads; and the concentration of livestock and wildlife in some areas have exposed bare soil and provided a seedbed for the establishment of invasive plant species in the planning area. These, as well as other historical vegetative disturbances and activities (e.g., fire, fire suppression, recreation, and OHV use), have encouraged the spread of invasive grasses and invasive species in the planning area. The combined effects of agriculture, grazing, fire, fire suppression, energy and mineral development, and, in some cases, drought, have altered the structure, composition, and site of some vegetative types within the planning area. 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.

Cooperative Management in Invasive Plant Species and Pest Control

The BLM controls invasive plant species on public lands through cooperative agreements with the Custer, Prairie, Dawson, Richland, and Carter county weed control districts. The BLM also implements contracts for specific areas to control invasive plant species and employs a seasonal weed crew to treat smaller infestations. The MCFO has, and will continue to, control and manage noxious weeds through the invasive species program. The BLM’s resource users prepare pesticide application records incorporating district invasive plant species control guidelines. The primary invasive species targeted for control in the planning area include Russian knapweed, spotted knapweed, diffuse knapweed, leafy spurge, Canada thistle, common hound’s-tongue, field bindweed, and salt-cedar. These species are typically found in sagebrush and grassland, desert shrub, and riparian and wetland communities.

Methods used to reduce invasive plant species density and control population size across the planning area include chemical, mechanical, biological, or a combination of these treatments. Approximately 1,050 acres of invasive plant species are chemically treated annually within the planning area. The MCFO BLM also addresses weed control relating to lands and realty, wildlife, range, recreation, oil and gas, and other mineral-related actions. To date, the county weed control districts have been able to meet the control needs of BLM-administered lands with biological control agents and herbicides but the future rate of invasion and spread of invasive plant species may exceed current capabilities. Users of BLM-administered land will continue to be required to meet invasive plant species control needs. Management challenges for invasive plant species include, managing BLM-authorized activities in the planning area that disturb the soil or otherwise create an opportunity for the establishment of invasive plant species; educating resource users regarding the spread, early detection, and control of invasive plant species; and determining effectiveness of invasive plant species control without a completed invasive plant species inventory and a comprehensive invasive plant species management program. These challenges require coordination across all of the BLM’s resource programs to develop, integrate, and implement aggressive management techniques and strategies for controlling the impacts and spread of invasive plant species in the planning area.

FISH AND WILDLIFE

AQUATICS

The aquatic resources in the RMP planning area include aquatic wildlife and habitat for fish, aquatic arthropods (insects and crustaceans), amphibians, reptiles, and bivalves. The habitat consists of rivers, streams, lakes, and reservoirs that provide habitat for a variety of aquatic wildlife and riparian communities (and their varying lifecycle stages). Nomenclature from the MNHP Montana Field Guide was used (MFWP and MNHP 2012).

Based on known fish presence (MFWP 2010b; Ostovar 2007), there are approximately 293 miles of fish-bearing streams on BLM-administered lands; however, the discovery of more prairie streams that support native fish and other aquatic wildlife continues. Prairie fish are constantly moving through a landscape that balances, at the local and landscape scale, between drying and flooding stages.

Aquatic wildlife habitat is inherently connected at a landscape scale to soil, water, and riparian resources, which are in turn driven by short-term and long-term climate factors. In terms of climate impacts to aquatic systems, climate driven changes to these other resources are directly or indirectly linked with aquatic wildlife habitat.

There is evidence that recent warming is affecting aquatic biological systems (IPCC 2007). In the Northern Great Plains, aquatic wildlife are adapted to warm, turbid conditions of prairie streams and rivers. At this time, there is less conclusive evidence for how warming would affect aquatic wildlife in this region. In cold-water systems, for example, 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 2007). Increased temperatures would raise water temperatures in lakes, reservoirs, rivers, and streams. Fish populations are expected to decline because of warmer waters, which could lead to the closure of fishing waters (Karl et al. 2009), particularly for cold-water fisheries. Presumably, if water temperatures in the Northern Great Plains increased significantly, changes in fish populations would also occur.

Warming trends would also initiate drying events (Johnson et al. 2010) in aquatic wildlife habitat, which may be the most significant impact to prairie streams in this region, as prairie streams already balance between drying and flooding stages. In this region, intermittent streams are hotspots of biological diversity. Drying events would have dramatic deleterious effects to native biodiversity.

Climate change is likely to combine with other human-induced stress to further increase the vulnerability of ecosystems to pests, invasive species, and loss of native species. Exotic species, such as American bullfrogs recently discovered in the region, may be able to expand their ranges and impact native biodiversity.

Aquatic resource conditions of streams are strongly related to riparian vegetation, upland range conditions, land use impacts, and quality and quantity of in-stream water. Habitat conditions throughout the planning area vary between and within water bodies; the upper and middle reaches of smaller streams may be intermittent, while the lower reaches may receive perennial flows, resulting in different habitat conditions and different aquatic communities within the same stream. While prairie fishes are adapted to these cycles of drying and flooding and can thrive in these intermittent pools, provided land-use impacts are not severe (Bramblett, Johnson, Zale, and Heggem 2005), prairie streams are considered endangered ecosystems (Dodds et al. 2004).

A critical component in maintaining aquatic wildlife habitat, riparian vegetation is a source of organic nutrients and food items for the prairie stream ecosystem, provides in-stream habitat for fish and invertebrates, adds structure to the banks, and reduces erosion; when riparian vegetation senesces and falls into the stream, it adds cover, habitat complexity, and moderates water temperatures. In some cases throughout the planning area, riparian habitats have been degraded and the results include increases in erosion and sedimentation, shallower and wider streams (which increases evaporation), increases in temperature fluctuations, and critically low oxygen content levels; these effects collectively reduce or degrade available aquatic wildlife habitat.

The linear characteristics of aquatic habitat coupled with the wide dispersal and scattered parcel distribution of BLM-administered lands in the planning area results in difficulties describing specific habitat conditions relative to one owner. As a result, the current conditions of aquatic resources in the planning area are presented in terms of overall habitat conditions, stream types, and fish species distribution and diversity.

Major Watersheds and Waterbodies

The Missouri River flows with an annual average (1959 to 2009) discharge of 9,936 cubic feet per second (cfs) at Culbertson, Montana (USGS 2009a), and the Yellowstone River flows over a drainage area of 68,392 square miles and with an average annual (1911 to 2009) discharge of 12,780 cfs at Sidney, Montana (USGS 2009b).

The Yellowstone is a free-flowing river system with no impoundments but the Missouri has several large impoundments (including the Fort Peck Reservoir) in the planning area. Most of the planning area is semi-arid, resulting in highly variable stream-flow, particularly in the small rivers and streams. Peak flows generally occur March through May as a result of melting snow and rainfall. Thunderstorms also cause short durations of increased flows in the summer (see the *Water Resources* section for more information).

Variable streamflows affect water quality in a number of ways, including leaching of soluble minerals from surface soils and underlying aquifers, particularly during low flow periods. However, during high flows most of the water entering the streams is from recent precipitation runoff, which quickly enters the stream channels and is in contact with the soils for a short time, allowing little opportunity for the minerals to leach out of the soil.

Primary reservoirs and lakes include the Fort Peck Lake, Tongue River, and Whitetail reservoirs and the Medicine and Box Elder lakes. The largest lakes or reservoirs in the planning area are Fort Peck Reservoir (249,349-acre surface area), Tongue River Reservoir (3,600 acres), and Medicine Lake (8,930 acres). Because they are larger in size and greater in depth, these waterbodies are able to provide habitat for a wide array of fishes with different niches; all three of these water bodies are managed for a combination of cold- and warm-water fish species (MFWP 2010b). Most of the remaining smaller reservoirs are habitat for warm-water species and some cold-water species such as rainbow trout (*Onchorhyncus mykiss*). The BLM categorizes 16 reservoirs as sport-fish reservoirs (Table 3-19 and Map 55). These are smaller reservoirs with inconsistent water volumes. In 2009, less than half had enough water to sustain fish populations.

**TABLE 3-19.
BLM-ADMINISTERED FISHING RESERVOIRS IN THE PLANNING AREA**

Name	County	Acres	Habitat Improvement
Clark	Prairie	45.28	Windmill, Exclosure
Beardsley, Pat	Custer	18.06	Windmill
Silvertip	Prairie	14.69	Windmill, Woody debris
Marshall	Prairie	13.60	Windmill, Woody debris
Rattlesnake	Dawson	13.44	Windmill, Woody debris
South Fork	Prairie	13.41	
Homestead	Prairie	13.32	Windmill, Woody debris
Grants	Prairie	10.69	Windmill, Woody debris
Maier	Fallon	7.42	Windmill
Harms	Prairie	6.61	Windmill
Oil Pump	Prairie	5.21	Windmill, Exclosure
Sidney	Carter	2.96	Windmill
Frigid	Carter	1.41	Windmill
Boulware	Custer	0.98	Windmill, Exclosure
Rest Reservoir	Custer	0.88	
Dean S.	Custer	0.56	Windmill, Exclosure

Fish and Aquatic Wildlife, Use and Relative Abundance

There are several amphibians and reptiles throughout the planning area (Werner, Maxell, Hendricks, and Flath 2004). In general, little is known about the ecology or habitat of many of these species; however, many are associated with prairie streams for all or part of their life cycle. Woodhouse's toads (*Bufo woodhousii*) use larger rivers and reservoirs, particularly along the Yellowstone and Missouri rivers, for part of their lifecycle. Boreal chorus frogs (*Pseudacris maculata*) use shallow water areas for breeding and tadpole development, but then become primarily terrestrial. Amphibians in the planning area include Great Plains toads (*Bufo cognatus*), northern leopard frogs (*Rana pipiens*), plains spadefoot toads (*Spea bombifrons*), and the tiger salamander (*Ambystomia tigrinum*). All four of these species depend on water resources, including prairie streams, for various parts of their lifecycle, and all three of these species are considered sensitive species and species of special concern by the BLM and Montana Fish, Wildlife, and Parks (MFWP), respectively (see the *Fish and Wildlife, Special Status Species, Aquatics* section for more information).

Reptiles in the planning area include spiny softshell turtles (*Apalone spinifera*), snapping turtles (*Chelydra serpentine*), painted turtles (*Chrysemys picta*), western hog-nosed snakes (*Heterdon nasicus*), milksnakes (*Lampropeltis triangulum*), plains gartersnakes (*Thamnophis radix*), common gartersnakes (*Thamnophis sirtalis*), terrestrial gartersnakes (*Thamnophis elegans*), eastern racers (*Coluber constrictor*), gophersnakes (*Pituophis catenifer*), smooth greensnakes (*Opheodrys vernalis*), prairie rattlesnakes (*Crotalus viridis*), greater short-horned lizards (*Phrynosoma hernandesi*), and common sagebrush lizards (*Sceloporus graciosus*). Spiny softshell turtles, snapping turtles, western hog-nosed snakes, milksnakes, and greater short-horned lizards are on the BLM Sensitive Species List and the MFWP Species of Concern List, while common sagebrush lizards and smooth greensnakes are on the MFWP Species of Concern List. Spiny softshell turtles, snapping turtles, painted turtles, western hog-nosed snakes, milksnakes, plains gartersnakes, common gartersnakes, terrestrial gartersnakes, eastern racers, and smooth greensnakes depend on water resources, including prairie streams, for all or part of their life cycle. The planning area supports 63 species of fish, including 35 native and 28 nonnative species (Holton and Johnson 2003). Fish use varies considerably throughout the planning area, with the greatest numbers of fish species found in the larger rivers and more downstream reaches of tributary streams and comparatively fewer species present in upstream tributary reaches. MFWP has identified chronic (most years) or periodic (drought years) dewatering concerns for certain reaches of the Musselshell, Powder, and Tongue rivers (MFWP 2010b).

The greatest fish diversity (46 species) occurs in the Missouri River, which is habitat for 33 native species (MFWP 2010b). Of the other large rivers in the planning area, the Yellowstone River has 28 native species (40 total); the Tongue River, 25 (39 total); and the Musselshell River, 28 (38 total). The other major rivers and streams in the planning area typically support 17 to 30 total species and 12 to 25 native species. Many of the same fish species are abundant or common in most of these drainages, although species diversity is typically greater in the lower reaches of these streams.

The most abundant game fish species in the planning area include channel catfish (*Ictalurus punctatus*), northern pike (*Esox lucius)*, sauger (*Sander canadensis*), smallmouth bass (*Micropterus dolomieu*), and walleye (*Sander vitreus*) (MFWP 2010b). Less abundant game species include rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*), largemouth bass (*Micropterus salmoides*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), yellow perch (*Perca flavescens*), paddlefish (*Polyodon spathula*), burbot (*Lota lota*), Chinook salmon (*Oncorhynchus tshawytscha*), kokanee salmon (*Oncorhynchus nerka*), cisco (*Coregonus artedi*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*). Cold-water fisheries are maintained primarily through hatchery planting programs, primarily in the reservoirs, ponds, and lakes in the planning area.

The most dominant non-game fish species are goldeye (*Hiodon alosoides*), common carp (*Cyprinus carpio*), sand shiner (*Notropis stramineus*), flathead chub (*Platygobio gracilis*), fathead minnow (*Pimephales promelas*), lake chub (*Couesius plumbeus*), creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*), green sunfish (*Lepomis cyanellus*), and white sucker (*Catostomus commersoni*).

Of the large reservoirs in the planning area, Fort Peck Lake contains the most diverse fish species (approximately 50 species). Sixteen species, including two species of salmon (Chinook and kokanee), mostly game fish, have been introduced to develop sport-fishing opportunities, and the reservoir's walleye fishery has been of particular interest to resident and non-resident anglers. The Tongue River Reservoir has 19 species, and Medicine Lake contains three species.

Pallid sturgeon is listed as endangered under the ESA, while blue suckers (*Cycleptus elongates*), northern redbelly x finescale dace hybrids (*Phoxinus eos x phoxinus neogaeus)*, paddlefish, pearl dace (*Margariscus margarita*), saugers, shortnose gars (*Lepisosteus platostomus*), sicklefin chubs (*Macrhybopsis meeki*), and sturgeon chubs (*Macrhybopsis gelida*) are species of concern listed with MFWP.

Limiting Factors

Principle factors limiting or affecting aquatic resources in the planning area include the lack of a normative flow regime; loss or degradation of riparian habitat; habitat fragmentation; livestock grazing damage; past and current oil, gas, and mining practices; and excess siltation due to the various land use activities. The large number of ponds and reservoirs in the planning area disrupt the landscape scale linear connections that drive stream ecosystem processes and lead to landscape-scale water evaporation (Vannote, Minshall, Cummins, Sedell, and Cushing 1980; Dodds et al. 2004).

Nonnative fish species can contribute to predation, competition, and other indirect effects. The American bullfrog (*Rana catesbeiana*) has been documented on the Yellowstone River upstream of the planning area. If this species moves into the planning area, they have the potential to cause serious problems with native aquatic wildlife. Riparian invaders in the planning area, such as salt-cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*), may degrade aquatic wildlife habitat by consuming large amounts of water. These species can outcompete native riparian species that are key components of the physical and chemical habitat and those that provide food and substrate for aquatic wildlife. Introduced fish species, particularly game fish, are ubiquitous in the planning area. Impacts of introduced fishes on native fish communities include predation, introduction of diseases and parasites, competition for food and habitat, and hybridization. However, some nonnative species (e.g., walleye, smallmouth bass, and rainbow trout) are the foundation of popular fisheries that provide recreational and economic benefit to many Montanans.

Proposed Carter Master Leasing Plan Area

Within the proposed MLP, the Little Missouri River, Boxelder Creek, and many smaller intermittent streams are fish-bearing streams. Frigid Reservoir, a BLM sport-fishing (rainbow trout) reservoir occurs in the proposed MLP area.

TERRESTRIAL

The BLM is responsible for managing wildlife habitat on BLM-administered lands, including approximately 2.8 million acres within the planning area. Managing wildlife species populations is the responsibility of state and federal wildlife management agencies. MFWP manages resident wildlife populations and migratory game birds in two regions (MFWP Region 7 and portions of Region 6) that include the planning area. The USFWS provides regulatory oversight for all species listed, proposed for listing, or candidates for listing under the ESA. The USFWS also administers the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), which protects migratory bird species, whether hunted (waterfowl) or not (songbirds) and the Bald and Golden Eagle Protection Act, which prohibits anyone from taking bald and golden eagles, their eggs, parts, or their nests without a permit issued by the USFWS. This includes protection for eagles from impacts of human-initiated activities primarily around active, alternate, and historical nest sites. This section describes the historic and existing conditions, wildlife habitat, and management of wildlife habitat in the planning area.

Historic Habitat Reduction and Fragmentation

Historical conditions for biological resources are a function of the interaction of physical (e.g., climate, soils, geology, and elevation) and disturbance factors (e.g., fire, grazing, and drought). Prior to extensive changes caused by Euro-American settlement, physical and natural factors combined to produce the biological diversity present in the planning area. Wildlife resources were noted to be exceptionally abundant by early explorers. Human actions during the subsequent 200 years substantially changed the pattern, composition, structure, and function of plant and animal communities.

The most pervasive and extensive change to the grassland ecosystems of North America is the conversion of nearly 70 percent of native grasslands in the Great Plains to agriculture (Samson, Knopf, and Ostlie 2004). The conversion was facilitated by the Homestead Act of 1862 in the United States and the Canada Dominion Act of 1872; under the Homestead Act, nearly 1.5 million people acquired and plowed over 309,000 square miles (800,000 square kilometers) of land, primarily in the Great Plains (Samson et al. 2004). The impacts of land conversion in the late 1800s and early 1900s were greatest in the tallgrass portion of the Great Plains. The Northwestern Glaciated Plains ecoregion, which encompasses most of the planning area, has experienced less conversion than other areas of the Great Plains, with about 60 percent remaining in native vegetation (Samson et al. 2004).

Currently, herbaceous vegetation covers about 59 percent of the planning area, with approximately 30 percent dominated by shrub species. However, the conversion of native habitats continues throughout the planning area and may increase as demand for bio-fuels grow and additional crops are modified to grow in arid environments.

Converting native grasslands to agricultural lands not only resulted in a direct loss of habitats for native wildlife, it began a process of habitat fragmentation. Habitat loss is exacerbated when fragmentation reduces habitat size, isolates remaining habitat patches below the size thresholds necessary to support components of biological diversity, or blocks the movement of animals between habitat patches. As large contiguous blocks of habitat are broken into smaller blocks, they became more isolated from one another by dissimilar habitats and land uses. As this occurs, individual plant and animal species and communities of plant and animal species incur adverse impacts, including isolation.

Effects of habitat fragmentation can occur on multiple scales and vary by species and type of fragmentation. Individual species have different thresholds of fragmentation tolerance. Large birds (e.g., golden eagle, *Aquila chrysaetos*) have large territorial requirements but may be able to utilize habitat fragments smaller than their original territory while smaller birds (e.g., Sprague's pipit, *Anthus spragueii*) favor habitat areas larger than their defined territories (Davis 2004).

Linear features, including roads, railroads, trails, irrigation systems, and rights-of-way (ROWs) fragment the planning area. Interstate 94 and a network of state highways, county roads, local roads on private and public lands, and the Burlington Northern Railroad dissects much of the planning area. The development of irrigation and flood control reservoirs, such as the Fort Peck Reservoir and its associated water-distribution system, have also contributed to habitat fragmentation in and along the borders of the planning area. Some fences can also direct and indirectly fragment habitats by blocking migration routes for wildlife species, such as pronghorn.

Changes in vegetation can also fragment native habitats. Irrigation water has supported the conversion of native plant communities to hayfields, pastures, and cropland, fragmenting habitats for some native species. Roads and OHV use can promote the spread of invasive vegetation species through vehicular traffic, and invasive species infestations can further exacerbate the fragmentation effects of roadways. The conversion of large acreages of sagebrush to predominately grassland communities can fragment habitat for sagebrush-dependent species, such as the greater sage-grouse (*Centrocercus urophasianus*). Recent interest in bio-fuel production on private lands has resulted in an increase in the conversion of native grasslands to cropland and the conversion of lands formerly enrolled in the Conservation Reserve Program (CRP), further emphasizing the importance of BLM-administered lands for the maintenance of large blocks of native grasslands and shrublands. Although the linear features identified in the previous discussion are largely responsible for habitat fragmentation, fragmentation also occurs at population centers and other developments where humans live, recreate, and work. Development of private parcels, subdivisions, or ranchettes (and their associated buildings, roads, fences, and utility corridors) has also contributed to habitat loss and fragmentation.

Remaining habitats have also been impacted by changes in ecologically important disturbances. Historical disturbances that shaped plant and animal habitats were primarily drought, grazing, and fire. Drought occurs at broad scales and is unpredictable. Current variability in precipitation patterns and drought cycles is presumably similar to past patterns, although recent global climate changes may have profound changes in drought occurrences.

The loss, fragmentation, and degradation of native grasslands throughout the Great Plains have severely affected native wildlife associated with grassland habitats.

Large numbers of bison formerly moved nomadically through the planning area in response to changes in vegetation associated with drought, past grazing, and fire. The number of bison estimated to inhabit the Great

Plains prior to Euro-American settlement is 30 to 60 million animals but only a few thousand animals remained by 1890 (Knapp et al. 1999). The last wild bison in the planning area were probably killed in 1885. Bison grazing occurred in large areas as huge herds moved through localities, and the impacts of these herds on the vegetation, soils, and riparian areas were probably extensive. The interval between grazing episodes may have ranged from one to eight years (Samson et al. 2004). Managed domestic livestock grazing (primarily cattle) has replaced these grazers, but their impact on grassland habitats is much different in scale and duration.

Large fires often occurred, and fire regimes were probably highly variable depending on rainfall and subsequent grass growth (Umbanhowar 1996). These burns also removed much of the vegetation, which resulted in continual shifts in the abundance and distribution of species across large areas, with the direction and extent of vegetation response mediated by drought and bison or locust grazing (Umbanhowar 1996).

In some areas, land use activities such as agriculture, oil and gas development, fire management, OHV use, recreation, and transportation have contributed to the degradation of remaining wildlife habitats. Examples of habitat degradation include:

- grazing management that has changed vegetation composition and increased soil compaction or erosion;
- oil and gas well and associated infrastructure development that has disturbed soil for well pad and road development;
- increased human activity levels contributing to soil erosion, habitat fragmentation, and wildlife disturbance;
- fire suppression that has depleted or completely removed the natural fire regime with which habitats evolved;
- OHV use that has spread invasive weeds and disturbed wildlife;
- recreation activities that have disturbed wildlife; and
- road placements that have contributed to habitat fragmentation.

Other sections of Chapter 3 provide additional details regarding existing conditions of the resources and resource uses listed above.

Grassland birds, a suite of species adapted to differing grassland habitats resulting from the combination of historical disturbances noted above, have exhibited the steepest, most consistent and most widespread decline of any group of birds in North America (Samson and Knopf 1994). Black-tailed prairie dogs have been reduced to about 2 percent of their former numbers (Kotliar, Baker, Whicker, and Plumb 1999) and the black-footed ferret, which is associated with prairie dogs, was thought extinct until a small population was found in Wyoming in 1981. Although grizzly bears (*Ursus arctos*) and gray wolves (*Canis lupus*) have been extirpated throughout the Great Plains, they remain in the forested western portions of the state. Swift fox were extirpated in the northern Great Plains but have recently been reintroduced.

Historic impacts to wildlife habitat have occurred in varying degrees. Consequently, some areas contain well-functioning habitats while others contain poorly functioning habitat; some areas contain large, contiguous blocks of native habitat while other areas contain small, fragmented patches of native habitats.

The changes to native habitats noted above also benefited some species of wildlife. Ring-necked pheasants (*Phasianus colchicus*), gray (or Hungarian) partridge (*Perdix perdix*), and wild turkey (*Meleagris gallopavo*) have been introduced and responded positively to these habitat changes. These species have also become economically important game animals in the area. Raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), red fox (*Vulpes vulpes*), and white-tailed deer (*Odocoileus virginianus*) have also benefited from habitat changes and are more common now than in the past.

Wildlife response to surface-disturbing activities, facilities, and oil and gas activities are complex but well documented (BLM 2008g). Habitat fragmentation, both direct and indirect, has the potential to cause the greatest impacts to wildlife and wildlife habitat (Hebblewhite and Merrill 2008).

Research conducted in areas of energy development in Wyoming reported shifts in mule deer distribution and considerable declines in the Sublette mule deer population while population densities in control populations remained constant (Hebblewhite 2008). Additionally, although research documenting the impacts of energy development on pronghorn antelope is limited, a Wyoming study found that habitat fragmentation of previously undisturbed habitat resulted in reduced use or abandonment by pronghorn and that pronghorn consistently avoided (by 100 meters) producing wells located in suitable habitat (Berger et al. 2006).

Habitat fragmentation, both direct and indirect, has the potential to cause the greatest impacts to wildlife and wildlife habitat (Hebblewhite and Merrill 2008). The magnitude of the impact would depend, at least in part, on the timing and nature of the disturbance, winter conditions, species and habitat type present, physiological status of the individual, hunting pressure, and other disturbance factors. Other activities, such as bentonite mining, uranium development, mineral material sales, and other locatable mineral activities would cause similar impacts.

Habitat management challenges include:

- maintenance of heterogeneity in habitat composition and structure for grassland and shrubland communities;
- habitat fragmentation;
- invasion and spread of exotic species and invasive species;
- lack of a natural fire regime (although this should be tempered by potential increases in exotic grass species in recent burns);
- competition for forage between native ungulates and livestock;
- restoration of areas damaged by surface-disturbing activities;
- integrating treatments of multiple resource programs to achieve landscape-level objectives; and
- maintaining a distribution and diversity of these communities sufficient to support wildlife, special status species, livestock, and other competing multiple-use demands on BLM-administered lands.

Big Game

Big game species in the planning area include mule deer, white-tailed deer, pronghorn antelope, Rocky Mountain elk, and bighorn sheep (Table 3-20).

Mule deer (*Odocoileus hemionus*) are the most abundant big game species in the planning area and use the greatest variety of habitats. Areas of year-round mule deer distribution total more than 22 million acres in the planning area, including approximately 12 percent on BLM-administered lands. Approximately 6.89 million acres of mule deer winter range occur in the planning area, which includes 1.24 million acres of BLM-administered land (see Map 56 for big game crucial winter range in the planning area).

The planning area contains numerous large areas (more than 45,000 acres) of mule deer winter range (documented in the BLM GIS system). In eastern Montana, most mule deer and elk winter range is located on relatively large areas of land with a diversity of slopes, aspects, and topographic features. Winter range is often part of year-round habitat. Winter ranges are typically in areas of rough topography and are often dominated by shrub species that provide crucial browse. Breaks, badlands, and brushy draws are preferred in open prairie country. MacCracken and Uresk (1984) reported that both hardwood and pine forests were important to mule deer in southeastern Montana, with hardwood forests preferred. Escape and thermal cover are also important for maintenance and survival. Doghair stands of ponderosa pine and juniper are examples of important escapes and thermal cover used by mule deer in the northeastern portion of the planning area. Habitat such as riparian bottoms, agricultural areas, and forests are used as well, either yearlong or seasonally.

TABLE 3-20.
BIG GAME HABITAT AND DISTRIBUTION BY LAND OWNERSHIP IN THE PLANNING AREA

Species	Habitat or Distribution	Land Ownership (acres)							
		BLM-administered Acres (and Percentage of Habitat on BLM-administered Surface)	Other Federal	Tribal or BIA	State	Local	Private	Ownership Unknown	Total
Mule deer	Year-round distribution	2,746,454 (12%)	822,596	7,506	1,540,949	17,140	17,466,915	87,226	**22,688,787**
	Winter range	1,238,725 (18%)	245,122	1,149	478,669	11,322	4,894,334	21,567	**6,890,887**
	No data	518 (less than 1%)	1,402	1,622,015	107	0	4,661	138,359	**1,767,062**
White-tailed deer	More than 30 deer per square mile	21,710 (4%)	2,029	200	24,096	3,883	417,303	20,031	**489,252**
	15 to 30 deer per square mile	19,594 (4%)	78,342	1,113	21,613	0	408,251	5,291	**534,203**
	5 to 15 deer per square mile	36,238 (3%)	111,766	155	74,791	0	887,269	17,101	**1,127,321**
	Less than 5 deer per square mile or unoccupied habitat	2,668,713 (13%)	630,708	6,044	1,420,449	13,258	15,754,089	44,244	**20,537,718**
	Total white-tailed deer habitat	2,746,456 (12%)	822,846	7,512	1,540,948	17,140	17,466,912	86,667	**22,668,481**
	No deer density or general habitat data	518 (<1%)	1,153	1,622,009	107	0	4,660	138,908	**1,767,355**
	White-tailed deer winter range	107,561(4%)	211,814	97,888	160,926	3,816	1,996,261	64,705	**2,642,970**
Pronghorn antelope	Overall distribution	2,037,906 (11%)	251,508	1,386,215	1,248,118	13,186	13,601,449	68,504	**18,606,886**
	Winter range	634,350 (11%)	103,537	71,494	342,180	137	4,571,215	34,454	**5,557,366**
Rocky Mountain elk	Basic distribution	441,982 (10%)	700,388	446,350	202,945	1,132	2,534,850	60,273	**4,387,919**
	Winter range	261,199 (25%)	216,954	61,816	46,209	0	414,382	55,351	**1,055,911**
	Crucial winter range	2,404 (5%)	32,222	0	927	0	10,410	0	**45,963**
	Summer range	6,515 (4%)	48,179	54,504	2,408	0	46,748	18	**158,371**
	Crucial summer range	2,498 (7%)	5,931	0	1,185	0	27,050	0	**36,664**
	Migration habitat	247 (7%)	0	0	382	0	3,139	0	**3,768**
Bighorn sheep	Overall distribution	68,525 (18%)	0	0	27,170	0	292,436	208	**388,338**

Figures were rounded. Distribution and habitat data for mule deer, white-tailed deer, and bighorn sheep on tribal or BIA lands are incomplete. There is no designated bighorn sheep winter range in the planning area.

In the Powder River RMP area, mule deer use all habitat types, but generally prefer sagebrush, grassland, and conifer (BLM 1984). Broken terrain provides important cover in these habitats. Browse is an important component in the mule deer annual diet. MFWP observations (Youmans and Swenson 1982) indicate that 73 percent of the mule deer seen in winter concentration areas in southeastern Montana were in rough topography, particularly in pine-dominated habitats. Along the Powder and Little Missouri rivers, however, riparian habitat accounted for 94 percent of the wintering mule deer concentrations, probably due to the lack of rough breaks. These habitats are crucial to herd survival in the Powder River area, and there appears to be little or no seasonal migration of mule deer in southeastern Montana (BLM 1984).

Mule deer populations have declined and rebounded at least twice since the late 1970s. The population peaked in the early 1980s and then declined for approximately 5 years because of drought, poor winter survival, and liberal harvests (BLM 1995). Recent MFWP survey data for mule deer in the planning area indicated a 16 percent decrease from the long-term average in 2010 (H. Burt, personal communication, February 4, 2011). The fawn to adult ratio also showed decreases: the 10-year average (2000 to 2009) for fawn to adult ratio was 58.5 fawns per 100 adults and the 2010 survey showed 40 fawns per 100 adults (H. Burt, personal communication, February 4, 2011).

Although less abundant than mule deer, white-tailed deer (*Odocoileus virginianus*) are common in the planning area. White-tailed deer prefer riparian drainage bottoms and conifer areas, but they will also use a variety of other habitats. Areas of highest white-tailed deer concentration (more than 30 deer per square mile) total close to half a million acres, including approximately 4 percent of BLM-administered lands (MFWP 2005b). BLM-administered lands provide less than 1 percent of the more than 2.64 million acres of white-tailed deer winter range in the planning area.

During the winter, white-tailed deer using forested areas prefer dense canopy classes, moist habitat types, uncut areas, and low snow depths. Suitable winter range is a key habitat factor for white-tailed deer, and winter concentration areas occur almost exclusively in riparian and wetland habitats and dense pine (Youmans and Swenson 1982). Although white-tailed deer move on and off winter range, as dictated by seasonal habitat requirements, the animals do not migrate for long distances. The white-tailed deer population remains relatively consistent, despite periodic outbreaks of epizootic hemorrhagic disease, a non-contagious viral disease characterized by extensive hemorrhaging.

Pronghorn antelope (*Antilocapra americana*) are the second most abundant big game species in the planning area. Although these animals are generally associated with grasslands and shrublands, they will also use agricultural fields.

Approximately 11 percent of the more than 18 million acres of pronghorn antelope habitat in the planning area occurs on BLM-administered lands. BLM-administered lands also provide approximately 13 percent of the more than 1.4 million acres of winter range for the species in the planning area. The documented winter range of pronghorn antelope is most abundant in the southern and western regions of the planning area, particularly in Garfield and Rosebud counties.

Rocky Mountain elk (*Cervus canadensis*) are associated with grasslands, shrublands, woodlands, and riparian and wetland areas. The species is also common in the Missouri Breaks and scattered throughout the Custer National Forest including surrounding BLM-administered lands south of Miles City to the Wyoming and South Dakota borders. Seasonal habitat data indicate more than 1.0 million acres of Rocky Mountain elk winter range and more than 2.8 million acres of summer range in the planning area. Twenty-five percent of the overall winter range occurs on BLM-administered lands. Summer habitat is located primarily in the southern portion of the planning area while winter habitat is concentrated on the western border along the Musselshell River. Elk are expanding throughout the planning area, especially in portions of Big Horn and Powder River counties (and small portions of Custer County). Overall numbers are also increasing throughout the planning area.

Bighorn sheep (*Ovis canadensis*) in the planning area occur as a single herd and occupy a portion of 388,388 acres of habitat, located primarily in the Powder River Breaks area in Custer County (Map 57). Occasionally, they are also observed in the Pine Hills area. Approximately 18 percent of the occupied area occurs on BLM-administered lands. Bighorn sheep habitat includes cliffs, mountain slopes, and rolling foothills with open to semi-open conditions (i.e., rocks, grasses, shrubs).

Game Birds

Upland game birds in the planning area include sharp-tailed grouse (*Tympanuchus phasianellus*), greater sage-grouse, wild turkeys (*Meleagris gallopavo*), ring-necked pheasants (*Phasianus colchicus*), and gray partridges (*Perdix perdix*) (Table 3-21). The greater sage-grouse is considered a special status species and addressed further in *Special Status Species, Fish and Wildlife*. As with big game, upland game birds are considered priority species because the public expresses interest in hunting these species. BLM-administered lands provide approximately 11 to 13 percent of the habitat or distribution of upland game birds in the planning area. However, BLM-administered lands contain only 2 percent of the ring-necked pheasant habitat in the planning area.

TABLE 3-21.
UPLAND GAME BIRD HABITAT AND DISTRIBUTION BY LAND OWNERSHIP IN THE PLANNING AREA

Habitat or Distribution	Species						
	Sharp-tailed grouse	**Wild turkey**	**Ring-necked pheasant**			**Gray partridge**	
	Overall distribution	Occupied habitat	Good or excellent habitat	Fair habitat	Total pheasant habitat	Overall distribution	
BLM-administered Acres (and Percentage of Habitat on BLM-administered Surface)	2,712,102 (12%)	1,020,103 (13%)	43,942 (2%)	87,953 (3%)	131,895 (2%)	2,598,809 (11%)	Land Ownership (Acres)
Other Federal	816,030	528,921	24,763	1,629	26,392	616,565	
Tribal or BIA	1,325,320	3,386	4,788	1,454	6,243	1,629,506	
State	1,505,470	481,598	203,499	258,348	461,847	1,515,216	
Local	17,141	4,972	3,830	463	4,293	17,140	
Private	16,921,650	5,737,471	2,184,891	2,563,853	4,748,744	17,276,982	
Unknown	192,810	39,033	57,673	8,084	65,756	107,713	
Total	**23,490,521**	**7,815,483**	**2,523,387**	**2,921,784**	**5,445,171**	**23,761,931**	

Distribution and habitat data for wild turkey and ring-necked pheasant on tribal or BIA lands are incomplete. There are no areas designated as potential (unoccupied) turkey habitat in the planning area. Figures were rounded.

The primary threats to upland game bird populations in the planning area include habitat loss and adverse weather. Hunting can also affect upland game bird populations. However, as with big game, MFWP, regulates the amount of upland game bird hunting allowed and prevents hunting from exerting an undesirable effect on these populations. Approximately 1,483 sharp-tailed grouse lek sites have been located and mapped in the planning area, with 14 percent occurring on BLM-administered lands and 74 percent on private land.

Waterfowl in the planning area include 10 dabbling ducks, 13 diving ducks, and 5 species of swans and geese (BLM 1995). The planning area contains a portion of the Prairie Potholes region, which is the most important waterfowl-producing area in North America (Pashley and Warhurst 1999). The Prairie Potholes region includes portions of six states (Montana, North Dakota, South Dakota, Minnesota, Iowa, and Nebraska) and three Canadian provinces (Alberta, Saskatchewan, and Manitoba) (Bird Studies Canada 2005) and is characterized by mixed-grass and tall-grass prairie with numerous wetlands. The Prairie Potholes region also provides critical breeding and migration habitat for more than 200 other bird species, and breeding dabbling duck density in the area can exceed 100 pairs per square mile.

The presence of open water is the most important factor for waterfowl production; availability of grassland habitats next to open water is also important for many of the waterfowl in the planning area. Open water habitat in the planning area includes rivers and natural potholes as well as artificial reservoirs. The total area of open water, which is scattered throughout the planning area, encompasses about 241,079 acres. Natural and constructed islands on reservoirs and within major river corridors are important to Canada geese (*Branta canadensis*) and some duck species because they provide security from predators during nesting and brood rearing. In addition to use during breeding periods, waterfowl use agricultural fields and wetlands as well as the major rivers (including the Yellowstone and Missouri rivers), for roosting, cover, and feeding.

Howrey Island provides brood-rearing habitat for Canada geese and other waterfowl species. Other wildlife also inhabit the island (including bald eagles, white-tailed deer, ring-necked pheasants, numerous furbearers, and various non-game species). This 321-acre area, located in Treasure County, is one of the few islands in the Yellowstone River managed by the BLM.

Non-game Wildlife

Various non-game priority species occur in the planning area. Those that are federally listed, or considered sensitive species by the BLM are discussed in the *Special Status Species, Fish and Wildlife* section. Because they are sensitive to environmental conditions and associated with rare habitat (wetlands and riparian areas), amphibians and turtles are also priority species groups; however, global population declines of some species and the limited knowledge regarding occurrence and distribution of these species in the planning area also contribute to this classification. Amphibians and turtles (other than those addressed in the *Special Status Species* section) known or expected to occur in the area are discussed above in the *Fish and Wildlife, Aquatics* section.

Key threats to amphibians and turtles in the project area include loss of riparian and wetland habitats, alteration of these habitats (through fragmentation, changes in hydrology, erosion, and changes in riparian and aquatic vegetation), and effects from environmental contaminants.

Limiting Factors for Wildlife

Although there are some limiting factors (factors that limit species distribution and abundance) specific to individual wildlife species, there are a variety of shared factors among most species. The principle factors that limit or affect wildlife in the planning area include weather (severe winter or summer drought); disturbance from human activities; and habitat fragmentation, degradation, and loss.

Migratory Birds

As identified through the *Montana Partners in Flight Bird Conservation Plan* (2000), migratory birds in the planning area that are of greatest conservation concern and BLM Sensitive Species are the following: piping plover, mountain plover, interior least tern, burrowing owl, Sprague’s pipit, and Baird’s sparrow. Each of these species is addressed in earlier parts of this section.

Proposed Carter Master Leasing Plan Area

An area in Carter County has been identified for an oil and gas master leasing plan (MLP) (see *Oil and Gas* for more information on MLPs). The Carter MLP area contains big game crucial winter range, sage-grouse habitat, a great blue heron rookery, raptor nests, and reservoirs that support waterfowl (Table 3-22).

TABLE 3-22. BLM-ADMINISTERED BIG GAME CRUCIAL WINTER RANGE ACRES WITH OIL AND GAS DEVELOPMENT POTENTIAL IN THE PROPOSED CARTER MASTER LEASING PLAN AREA

Type of Acres	Big Game Crucial Winter Range
High Oil and Gas Development Potential Surface Acres	5,700
High Oil and Gas Development Potential Mineral Acres	18,000
Medium Oil and Gas Development Potential Surface Acres	40,000
Medium Oil and Gas Development Potential Mineral Acres	66,000
Low Oil and Gas Development Potential Surface Acres	39,000
Low Oil and Gas Development Potential Mineral Acres	64,000

Special Status Species, Aquatics

Great Plains toad breeding habitat includes glacial potholes, stock reservoirs, irrigation ditches, and small coulees (Werner et al. 2004). During the non-breeding season, they use adjacent prairie and other upland habitat. Threats to the species include contamination from herbicides and pesticides, habitat loss, and stream and reservoir management policies that negatively alter hydrology. Great Plains toads have been documented in most counties in the planning area.

Northern leopard frogs occur in and around wet meadows, shallow ponds, and slow-moving streams with an abundance of vegetation, which provides cover. Populations west of the Continental Divide have been disappearing in recent years, but the frogs are widespread and remain common east of the divide (Werner et al. 2004). Northern leopard frogs occur in all counties in the planning area.

The plains spadefoot uses ponds, predominantly temporary ones as well as surrounding areas with sandy or gravelly loam soils (Werner et al. 2004). The species has been documented in most counties in the planning area.

Snapping turtles, which occur in large rivers, lakes, ponds, and marshes, have been documented in the counties in the central and southern portion of the planning area.

Spiny softshell turtles occur in large rivers and reservoirs. Threats to the turtles include riverine sand and gravel mining, OHV use, and livestock grazing, which can destroy their nesting areas (Werner et al. 2004). In the planning area, spiny softshells occur along the Missouri and Yellowstone rivers and their immediate tributaries.

Greater short-horned lizards use sagebrush and short-grass prairie, particularly south-facing slopes, rocky coulee rims, and shale outcrops (Werner et al. 2004). Conversion of sagebrush habitat is likely the primary threat to the species. Greater short-horned lizards have been documented in most counties in the planning area.

Milksnake habitat includes grasslands and adjacent riparian areas, rocky outcrops, riparian zones, cedar-juniper hillsides, and margins of agricultural fields (Werner et al. 2004). The species occurs in the central and southern portion of the planning area.

The western hog-nosed snake is associated with areas of well-drained and sandy soils, such as riverbanks, old riverbeds, and sandstone outcroppings (Werner et al. 2004). Although this species has been documented in most counties in the planning area, few have been observed in Montana in recent years.

There is one federally classified fish species (pallid sturgeon) and eight special status fish species (including the blue sucker, shortnose gar, pearl dace, sauger, sicklefin chub, sturgeon chub, northern redbelly x finescale dace hybrid, and paddlefish) occurring in the planning area.

USFWS listed the pallid sturgeon as an endangered species in 1990, and it is designated a species of special concern in Montana (USFWS 1990b). The pallid sturgeon and the limited information concerning the species are the primary factors for its listing. Its historic range included the Missouri River; the middle and lower reaches of the Mississippi River; and the lower reaches of the Yellowstone, Platte, and Kansas rivers. The current distribution in the planning area is the Missouri River (downstream of Fort Peck Dam) and the Yellowstone River (downstream of the Cartersville Diversion Dam near Forsyth). Montana populations appear to contain old, large fish with no recent evidence of successful reproduction.

Although critical or essential fish habitat is not officially designated for pallid sturgeon, they prefer large, swift, turbid, and relatively warm free-flowing rivers. In Montana, the pallid sturgeon inhabits water with temperatures ranging from 32° to 86°F and, during the summer, water depths from 4 to 12 feet before moving to deeper water during the winter. The pallid sturgeon is most frequently captured over sand substrate in the Missouri River, but they have also been caught over gravel and rock substrate in the Yellowstone River. After spawning, free-floating larvae drift a substantial distance downstream for at least several days, leaving larvae subject to predation. However, basic parameters such as spawning location, substrate preference, water temperature, and seasonal activity have been poorly documented in the planning area.

Preventing extinction through the establishment of three captive broodstock populations in separate hatcheries is an immediate MFWP goal but the long-term objective is downgrading and eventual delisting of the species. Protection and habitat restoration is focused in six recovery areas, two of which are in Montana: the Missouri River above Fort Peck Reservoir and the lower reaches of the Yellowstone and Missouri rivers below the Fort Peck Dam. Habitat restoration can only be achieved through restoration of specific habitats in the Yellowstone and Missouri rivers through restoration of river flows and proper temperature and turbidity.

Special Status Species, Terrestrial

Special status species include species:

- proposed for listing, listed as threatened or endangered, or considered candidates for listing as threatened or endangered under the provisions of the ESA;
- listed by a state in a category such as threatened or endangered, implying potential endangerment or extinction; and
- those designated sensitive species by a BLM State Director.

Conservation of special status species means the use of all methods and procedures necessary to improve the condition of special status species and their habitats to a point where special status recognition is no longer warranted.

Special status species are plants and animals that require particular management attention due to population or habitat concerns. These species are either:

- federally listed threatened and endangered species (or these species' designated critical habitats);
- federally proposed species and proposed critical habitats;
- federal candidate species;
- species designated as threatened or endangered species by the state; or
- Montana BLM Sensitive Species.

The BLM coordinates its threatened and endangered species management with the USFWS and MFWP. The BLM initiates Section 7 consultation with the USFWS before approving or implementing any action that may affect listed species or designated critical habitat. Streamlined consultation procedures detailed in the July 27, 1999 memorandum of agreement and subsequent implementation guidance for Section 7 consultations are utilized to provide collaborative opportunities in the consultation process. The BLM has entered into a MOU with the USFWS to improve the efficiency and effectiveness of RMP-level Section 7 consultation processes under the ESA. Through this memorandum, the BLM agrees to promote the conservation of candidate, proposed, and listed species and to consult informally and formally on listed and proposed species (and designated and proposed critical habitat) during planning to protect and improve the condition of species and their habitats to a point where their special status is no longer necessary.

Federally listed species may have critical habitat considered crucial to species viability. For those listed species without critical habitat designation, the BLM cooperates with the USFWS to determine and manage important habitats. Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668–668d). Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 et seq.).

Special status wildlife species indicators reflect population levels, distribution, and quantity and quality of preferred and suitable habitat and the prey needed to support them. This includes a healthy genetic pool needed for adaptability to future circumstances and conditions as well as critical breeding habitat, wintering grounds, and corridors needed to support migrations. Indicators are detected through allotment evaluations, stream and vegetation monitoring, population surveys, the MNHP database, field observations, and USFWS data.

Most management actions would be directed at habitat maintenance and the processes that would provide habitat diversity in the planning area. Actions in areas in which species-specific management could improve individual special status species habitats or populations would be considered as long as they were also compatible with long-term persistence of other habitats and species.

If species occurring on BLM-administered lands in the planning area were added to the threatened and endangered list in the future, management actions would be developed to conserve, enhance, and protect the species in accordance with the ESA.

This section addresses the existing conditions of special status species wildlife habitat in the planning area by those special status wildlife species known to occur or considered likely to occur in the planning area (Table 3-23). Although present historically, the ESA-listed grizzly bear (Ursus arctos) no longer occurs in the planning area. Numerous migratory bird species are considered BLM Sensitive Species and are a special status group. Included in the bird species are USFWS Birds of Conservation Concern, which have been identified as species that, without additional conservation actions, are likely to become candidates for listing under the ESA and are in greatest need of conservation action. (This list has been updated from the 2002 Birds of Conservation Concern List.)

Sources of information for this section include GIS data from BLM, MFWP, the existing Big Dry and Powder River RMPs, MNHP, communications with regional biologists (BLM, USFWS, and MFWP), and a literature review.

Mammals

The gray wolf (*Canis lupus*) was classified endangered under the ESA on March 11, 1967, and was delisted on May 4, 2009. The first fair-chase hunting season for wolves in Montana was 2009. They are now protected and the United States Federal District Court reinstated endangered species protections for the gray wolf. As of that date (August 2010), gray wolves are now legally reclassified as endangered or nonessential experimental (eastern Montana). Gray wolves use a variety of habitats in their range and can be found in any area that supports adequate populations of hoofed mammals (ungulates), its major food source, and where persecution by humans is limited or absent. Currently, gray wolves do not occur as resident species in the planning area but dispersing individuals from the Yellowstone National Park ecosystem, western Montana, and Canada may pass through the planning area. They are not, however, expected to establish residency or packs in the area, and the planning area is not considered important for the recovery of gray wolves.

**TABLE 3-23.
SPECIAL STATUS WILDLIFE SPECIES KNOWN OR LIKELY TO OCCUR IN THE PLANNING AREA**

Species	USFWS Status	BLM Sensitive
Mammals		
Gray wolf	DM[1]	Yes
Black-footed ferret	Endangered	Yes
Black-tailed prairie dog, swift fox, and BLM-listed sensitive bats[2]	None	Yes
Birds		
Common loon, Franklin's gull, black tern, white-faced ibis, yellow rail, willet, Wilson's phalarope, golden eagle, ferruginous hawk, Swainson's hawk, peregrine falcon, northern goshawk, LeConte's sparrow, sedge wren, and Nelson's sharp-tailed sparrow	None	Yes
Interior least tern and whooping crane	Endangered	Yes
Piping plover	Threatened	Yes
Mountain plover, marbled godwit, long-billed curlew, burrowing owl, bald eagle, sage thrasher, loggerhead shrike, chestnut-collared longspur, McCown's longspur, Baird's sparrow, Brewer's sparrow, Lewis's woodpecker (*Melanerpes lewis*), pinyon jay (*Gymnorhinus cyanocephalus*), grasshopper sparrow (*Ammodramus savannarum*), and dickcissel (*Spiza americana*)	BCC[3]	Yes
Horned grebe (*Podiceps auritus)*, American bittern (*Botaurus lentiginosus*), prairie falcon (*Falco mexicanus*), upland sandpiper (*Bartramia longicauda*), black-billed cuckoo (*Coccyzus erythropthalmus*), short-eared owl (*Asio flammeus*), red-headed woodpecker (*Melanerpes erythrocephalus*), and sage sparrow (*Amphispiza belli*)	BCC	No
Greater sage-grouse	Candidate	Yes
Sprague's pipit	Candidate/BCC	Yes
Amphibians		
Great Plains toad, northern leopard frog, and plains spadefoot toad	None	Sensitive
Reptiles		
Snapping turtle, spiny softshell turtle, greater short-horned lizard, milksnake, and western hog-nosed snake	None	Sensitive
Fish		
Northern redbelly x finescale dace hybrid, blue sucker, paddlefish, pearl dace, sauger, sturgeon chub	None	Yes
Pallid sturgeon	Endangered	Yes

The table includes USFWS BCC (Bird Conservation Regions 11 and 17) and BLM Sensitive Species
[1]Delisted taxon, recovered, being monitored first five years
[2]Townsend's big-eared bat, spotted bat, pallid bat, fringed myotis, northern myotis
[3]Birds of conservation concern

The black-footed ferret (*Mustela frenata*) was listed as an endangered species in 1967 under a precursor to the ESA. The main causes of the species' decline included habitat conversion for farming, intentional efforts to eliminate prairie dogs (black-footed ferrets depend almost exclusively on prairie dogs for food and shelter), and disease (USFWS 2000). A captive breeding and reintroduction program was established for the animals, and the current USFWS goal is the establishment of 10 free-ranging populations of ferrets spread over the widest possible area within their former range, including portions of the planning area.

Historic records documented black-footed ferret occupation of habitat within the planning area but black-footed ferrets are not known to occupy habitat on BLM-administered lands at this time. There is a low probability that a relict population may occur, although this has not been detected in area surveys to date. Black-footed ferret reintroductions occurred on the Northern Cheyenne Reservation in 2009; however, based on geographical constraints and limited connective habitat, the probability that black-footed ferrets from this reintroduction site will migrate to BLM-administered lands within the planning area is low.

The planning area contains one of several potential black-footed ferret reintroduction sites in Montana and this site, which is an area of critical environmental concern (ACEC), is located in Custer and Prairie counties and includes 11,166 acres. Approximately 455 acres of BLM-administered lands are occupied by active prairie dog towns within this ACEC. Approximately 161 acres of BLM-administered lands and 2,017 acres of private lands with active prairie dog towns are located outside the ACEC boundary but within the general area recognized as the Custer Creek prairie dog complex, based on 2004 surveys (Knowles 2004).

Birds

Interior least terns *(Sterna antillarum)* migrate through the planning area, stopping at stock reservoirs during spring and fall; nesting habitat includes gravel islands associated with large rivers. In the planning area, interior least terns have been reported in the Yellowstone River below Miles City, near the eastern end of Fort Peck Reservoir above Fort Peck Dam, and along the Missouri River below Fort Peck Dam (Atkinson and Dood 2006a; MFWP and MNHP 2006). Of the 129,500 acres of least tern nesting habitat mapped within the planning area, 1,373 acres, approximately 1 percent of least tern nesting habitat (7,420 BLM-administered minerals and 5,778 oil and gas acres [subsurface]), are located on BLM-administered lands.

On June 28, 2007, the bald eagle (*Haliaeetus leucocephalus*) was removed from the federal list of threatened and endangered species but bald eagles are still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. In the western United States, bald eagle abundance has been increasing in recent years (USFWS 1999b). Bald eagles generally occur along rivers and lakes with abundant fish and waterfowl prey and adjacent large trees for nesting and roosting.

In the planning area, bald eagles commonly nest along the Yellowstone River in Rosebud, Prairie, Custer, and Treasure counties. One active bald eagle nest site, on Howrey Island in Treasure County, is present on BLM-administered lands in the planning area. During spring and fall migration and winter, bald eagles use the Yellowstone, Missouri, Tongue, Musselshell, and Powder rivers and wintering bald eagle use is particularly high at Fort Peck Reservoir along the Missouri River (MFWP and MNHP 2006).

The whooping crane (*Grus americana*) was classified an endangered species in 1967 under a precursor to the ESA. The main cause of the species' decline was conversion of pothole and prairie habitat for agriculture (USFWS 2005b). Continued threats to the birds include susceptibility to natural events (e.g., short, ice-free season in the northern breeding grounds, severe weather during migration and the wintering period, and hurricanes) due to low population size. Risk of contamination from potential oil spills along the Texas coast, the wintering ground for the only self-sustaining wild whooping crane population, is also a threat. The total whooping crane population as of March 2002 was 397 birds (114 were captive birds and 283 were wild birds) (USFWS 2005b). The whooping crane occurs as a transient or migrant species and does not breed in the planning area or any other portion of Montana (MFWP and MNHP 2006). Data on whooping cranes in the state are rare. Sightings of the birds have generally been in marshy areas and stubble and grain fields (MFWP and MNHP 2006). Whooping cranes have not been recently documented (1995 to 2006) in the planning area (MNHP, MFWP, and MT Audubon Society 2006).

In Montana, piping plovers *(Charadrius melodus)* are known to nest in the northern and northeastern portion of the state, specifically in Fort Peck Reservoir, Nelson Reservoir, occasionally in the Bowdoin National Wildlife Refuge, Alkali Lake, the Medicine Lake National Wildlife Refuge in Sheridan County, and the Missouri River below Fort Peck Dam (MFWP and MNHP 2006). Of the approximately 135,00 acres of piping plover habitat mapped within the planning area, approximately 730 acres are located on BLM-administered land. Surveys have documented one piping plover nesting and brood-rearing area within BLM-administered lands in the planning area. This area, in 16 acres in Sheridan County in the extreme northeastern portion of the planning area, is the Piping Plover ACEC. Trends in the abundance of piping plovers in eastern Montana are not available.

In 2002, the USFWS officially designated critical habitat (92,532 acres in the planning area in four separate units) for the Northern Great Plains breeding population of piping plover (USFWS 2002a); approximately 0.5 percent (507 acres of BLM-administered surface) and 9 percent (8,042 BLM-administered mineral acres) of the total acreage of designated critical habitat occurs on BLM-administered lands. Within the planning area, there are three units of designated critical habitat:

- MT-1, which includes 20 alkali lakes and wetlands in Sheridan County;
- MT-2, which includes the Missouri River from just west of Wolf Point, east to the North Dakota boundary; and
- MT-3, which includes areas near Fort Peck Reservoir.

The Sprague's pipit *(Anthus spragueii)* selects prairies with grasses of intermediate height and may require relatively large areas (approximately 170 acres in a study in Saskatchewan) of appropriate habitat (MFWP and MNHP 2006). Main threats to the species include habitat loss and alteration caused by of agriculture and overgrazing (MNHP et al. 2006). Sprague's pipits were found warranted, but precluded by higher priority actions for listing as a threatened or endangered species (USFWS 2010b). Although Sprague's pipits are rarely found in cropland or CRP land, they have been found to use nonnative planted grassland (USFWS 2010b). The USFWS (2010b) reports that pipit occurrence may be better predicted using vegetation structure rather than composition. Sprague's pipits have been documented in Daniels, Sheridan, Roosevelt, McCone, Richland, Dawson, Prairie, Custer, and Fallon counties within the planning area (MNHP et al. 2006). BLM biologists have observed Sprague's pipits in Carter and Prairie counties. Historical observations have also been documented for Wibaux and Big Horn counties (Lenard, Carlson, Ellis, Jones, and Tilly 2003).

Other BLM Sensitive Species

Mammals

In the planning area, black-tailed prairie dogs (*Cynomys ludovicianus*) occur in grassland and shrub grassland habitat. A model based on vegetation biomass, slope, and soils resulted in four vegetation types identified as preferred by prairie dogs: very low cover grasslands, salt-desert shrub, dry salt-flats, and mixed barren sites. Prairie dogs were found to be associated with slopes of 0 to 4 percent (Proctor, Beltz, and Haskins 1998).

Black-tailed prairie dogs provide unique habitat for a variety of prairie wildlife species and are considered a "keystone species" (a species and habitat depended on by numerous other wildlife species for forage and reproduction). Their potential decline from control, fragmentation, and plague may cause secondary declines to other species including special status wildlife species such as burrowing owls, mountain plovers, and ferruginous hawks. The existence of the secondary species hinges on maintaining viable populations of prairie dogs throughout its range. Black-tailed prairie dogs were once listed as a candidate species for listing under the ESA but were found not warranted for listing by the USFWS.

Black-tailed prairie dogs declined in abundance during the 1900s and the current estimated acreage of occupied habitat is considered much smaller than historical. Declines are attributed to intensive eradication programs, conversion of native rangelands, and sylvatic plague. In the planning area, black-tailed prairie dog colonies occupy approximately 39,800 acres, which includes Northern Cheyenne Tribal lands. Black-tailed prairie dog colony occupation on BLM-administered lands is estimated at approximately 10,500 acres. These estimates are based on a combination of the most recent surveys (Knowles 2004) available from 2003 to 2004; however, prairie dog colonies are subject to frequent fluctuations in size and population.

Thought to be common on Montana's eastern plains throughout the early 1900s, swift fox *(Vulpes velox)* were believed to be extinct by 1969, which was largely attributed to poisoning (MFWP and MNHP 2006). In recent years, the swift fox population has appeared to be expanding into Montana from Canada. Surveys conducted in recent years in Montana indicate swift foxes occur primarily in the north-central and northeastern portion of the state (Grenier 2003). The primary ongoing threat to swift foxes in Montana is competition with coyotes and red foxes (MFWP and MNHP 2006).

In the planning area, historical surveys (prior to 1999) recorded swift foxes in Carter, Powder River, Custer, Garfield, Richland, McCone, Dawson, Valley, and Sheridan counties. From 1999 to 2009, swift foxes have been recorded, including track sightings and observations in Daniels, Valley, Prairie, Roosevelt, Powder River, and Carter counties. In general, shortgrass and midgrass prairies, which encompass 9,369,372 acres (36 percent) of the planning area and 1,078,132 acres (39 percent) of BLM-administered land within the planning area, provide potential habitat for the species. However, because of small habitat patch size, fragmentation, or other factors, not all of these acres are suitable habitat for swift fox. A multi-agency group consisting of representatives from 10 state wildlife agencies and select federal agencies (including the BLM), the Swift Fox Conservation Team, is committed to ensuring the long-term conservation of swift foxes.

The BLM considers five bat species occurring in the planning area to be sensitive species: Townsend's big-eared bats (Corynorhinus townsendii), spotted bats (Euderma maculatum), pallid bats (*Antrozous pallidus*), fringed myotis (Myotis thysanodes), and northern myotis (Myotis septentrionalis). Bats are sensitive to disturbance at their roosting sites; the availability of suitable roosting sites (e.g., tree cavities, tree bark, caves, rock crevices, mines, and buildings), are key habitat components for these bats (Nagorsen and Brigham 1993).

Birds

Common loon *(Gavia immer)* nesting habitat is characteristically clear, oligotrophic, fish-bearing lakes with rocky shorelines, bays, islands, and floating bogs surrounded by forest (McIntyre and Barr 1997). Because they need large expanses of water for takeoff and landing, loons generally occur only in lakes larger than 10 acres (Strong 1990). These birds are extremely sensitive to human disturbance. In recent years (1995 to 2006), sightings of common loons within the planning area include non-breeding individuals at Medicine Lake National Wildlife Refuge and Fort Peck (MNHP et al. 2009). There are no known nests in the planning area.

Nesting habitat for the Franklin's gull *(Leucophaeus pipixcan)* includes wetlands, particularly large and permanent prairie marsh complexes (MFWP and MNHP 2009). During migration, the species use dry land, especially cultivated fields, as migration stopover sites (MFWP and MNHP 2006). In recent years (1999 to 2009), non-breeding Franklin's gulls have been documented in the planning area at Pirogue Island State Park (Miles City), along the Missouri River, and at unlisted locations in eastern Sheridan County (MNHP et al. 2009). Breeding and non-breeding individuals have been observed during this time at Manning Lake; Prairie and Richland counties; and other locations in central and eastern Roosevelt County.

Black tern *(Chlidonias niger)* nesting habitat consists primarily of wetlands, marshes, prairie potholes, and ponds with abundant emergent vegetation (MFWP and MNHP 2009); the birds nest occasionally on human-made islands as well. Threats to the birds include degradation and loss of wetlands, reductions in prey because of pesticide use, and disturbances at nesting colonies (MFWP and MNHP 2009). Non-breeding individuals have been observed at Medicine Lake National Wildlife Refuge, in unlisted locations in Sheridan County, near Bainville in Roosevelt County, and at the Terry sewage lagoon in Prairie County. In recent years (1999 to 2009), breeding black terns have been sighted in the planning area at Medicine Lake National Wildlife Refuge, Westgard Waterfowl Production Area, and other locations in eastern Roosevelt, Richland, and Daniels counties (MNHP et al. 2009).

Breeding habitat for the white-faced ibis *(Plegadis chihi)* includes wetlands, marshes, ponds, and swamps with pockets of emergent vegetation (MFWP and MNHP 2006). Threats to the birds are similar to those mentioned above for black terns (MFWP and MNHP 2006). In recent years (1999 to 2009), breeding white-faced ibises have been observed in the planning area at Manning Lake (Fort Peck Indian Reservation), while non-breeding individuals have been observed at Gaffney Lake and near Homestead, Montana in Roosevelt and Sheridan counties (MNHP et al. 2006).

Breeding habitat for the yellow rail *(Coturnicops noveboracensis)* consists of wet meadows and other wetlands with emergent vegetation, especially grasses, rushes, and bulrushes; the primary threat to this species is loss of this breeding habitat (MFWP and MNHP 2006; MNHP et al. 2006). In recent years (1995 to 2006), breeding yellow rails have been observed in the planning area near Homestead and Westby, Montana, while non-breeding individuals have been observed near Westby (MNHP et al. 2006).

At one time, the mountain plover *(Charadius montanus)* was widely distributed across short-grass prairies on the western Great Plains, occupying a range that extended from Montana to New Mexico and Texas. Although this species does not winter in Montana, it may breed within the planning area, particularly in black-tailed prairie dog towns. Mountain plovers are transitory in other parts of the state, including the Greater Yellowstone Ecosystem, and currently breed on sites in central, north-central, and southwest Montana as well as a location north of Ingomar, Montana. Blaine and Phillips counties currently support the bulk of nesting mountain plovers in Montana. No mountain plovers were detected in surveys conducted from 2002 to 2005 in proposed CBNG drilling and pipeline development areas in Big Horn, Powder River, and Rosebud counties.

Conversion of native prairies to agriculture has significantly reduced suitable breeding habitats for this species; mountain plovers prefer relatively flat sites with very short grass and scattered cactus as well as high, arid plains and shortgrass prairie with blue grama-buffalo grass communities. However, intensive grazing is beneficial for mountain plovers, and they regularly occupy prairie dog towns. Records indicate that mountain plovers have declined in abundance in Montana over the past century, a possible result of increased irrigated agriculture or prairie dog control (MFWP and MNHP 2006). Limited mountain plover surveys have been conducted in the planning area and its occurrence in the area is not well known. In recent years (1999 to 2009), only two mountain plovers, observed north of Ingomar, Montana, have been sighted in the planning area (MNHP et al. 2009).

Although the mountain plover was proposed for a threatened listing under the ESA in the fall of 2002, the USFWS decided to reopen the comment period in 2010 on the proposed rule to list the mountain plover as a threatened species (USFWS 2002b) and to complete a new final determination on the proposal by May 1, 2011. After a thorough review of all available scientific and commercial information, the USFWS has determined that the mountain plover is not threatened or endangered throughout all or a significant portion of its range. Currently, the mountain plover is a BLM Sensitive Species.

Ducks at Clark Reservoir in Prairie County.

Marbled godwit *(Limosa haemastica)* breeding habitat includes short, sparsely to moderately vegetated areas, including native grasslands and wetlands (MFWP and MNHP 2006), while migration stopover sites include a variety of wetlands. Breeding marbled godwits have been observed in the planning area in recent years (1999 to 2009), and non-breeding individuals have been observed at and near the Fort Peck Dam (MNHP et al. 2009).

Long-billed curlews *(Numenius americanus)* will use agricultural fields as stopover sites during migration but breeding habitat consists primarily of native grasslands; loss of breeding habitat is the primary threat to the species (MNHP et al. 2006). In recent years (1995 to 2006), breeding long-billed curlews have been sighted in the planning area along the breeding bird survey routes near Circle, Savage, and Locate, Montana (MNHP et al. 2006). A non-breeding individual was observed in Roosevelt County during this time.

Willet *(Tringa semipalmata)* breeding habitat includes sparsely vegetated, short-grass prairies (and similar grasslands) near shallow wetlands (MFWP and MNHP 2006). The species also occasionally uses croplands. In recent years (1995 to 2006), breeding willets have been observed in the planning area at the Fox Lake Wildlife Management Area; Lonetree Lake, UL Bend, and Medicine Lake National Wildlife Refuges; in Fallon County; near Westby, Jordan, Redstone, Ingomar, Oswego, and Ekalaka, Montana; and in northeast Sheridan County

(MNHP et al. 2006). Non-breeding individuals were also observed during this time at Pirogue Island State Park, Medicine Lake National Wildlife Refuge, and in the Miles City and Bainville, Montana, areas.

Wilson's phalaropes *(Phalaropus tricolor)* use lakes, ponds, and flooded fields in the spring and marshy lake and pond borders in the summer (MFWP and MNHP 2006); the primary threat to the birds in the planning area is habitat loss (MNHP et al. 2006). In recent years (1995 to 2006), breeding Wilson's phalaropes have been observed in the planning area at the Medicine Lake National Wildlife Refuge; in Sheridan, Fallon, Treasure, and Rosebud counties; and near Ekalaka and Webster, Montana (MNHP et al. 2006). Non-breeding individuals were observed during this time in the Fox Lake area near Jordan and Sumatra and in Sheridan, Richland, and Fallon counties.

Golden eagles *(Aquila chrysaetos)* nest on cliffs and in large trees but forage over open areas such as grasslands and open woodlands (MNHP and MFWP 2006). In recent years (1999 to 2009), breeding golden eagles have been observed in the planning area at the UL Bend and Medicine Lake National Wildlife Refuges; along the Missouri River in Roosevelt County; and near Ingomar, Forsyth, Redstone, Fort Peck, Locate, and Decker, Montana (MNHP et al. 2009). In winter, golden eagles have been observed at the Medicine Lake National Wildlife Refuge; in Sheridan and Roosevelt counties; and near Fort Peck, Plevna, and Homestead, Montana. Twenty-six golden eagle nest sites are documented on BLM-administered land in the planning area, with 171 reported across the planning area; however, the number of active nests is unknown.

Great blue heron at Hay Draw Travel Management Area.

Burrowing owls *(Athene cunicularia)* are widely distributed across eastern Montana, where they occur in open grasslands and use abandoned mammal burrows (primarily prairie dog and badger) for nesting (MFWP and MNHP 2006). In recent years (1995 to 2006), breeding burrowing owls have been observed in the planning area at the Charles M. Russell National Wildlife Refuge and Fort Peck Reservoir; near Custer, Decker, Forsyth, Ingomar, and Locate, Montana; and in Garfield, McCone, Sheridan, Rosebud, Treasure, Custer, Prairie, Big Horn, and Roosevelt counties (MNHP et al. 2006). As of 2006, 50 burrowing owl sites, including 9 on BLM-administered lands, were known to occur in the planning area.

Ferruginous hawks *(Buteo regalis)* breed in eastern Montana but rarely occur in the area during winter (MFWP and MNHP 2006). Habitat for these birds includes grasslands, sagebrush, and other brush lands. Primary threats to ferruginous hawks include losses (from agriculture) of primary and prey habitat (which decreases prey species numbers) as well as deliberate eradication programs aimed at prey species (e.g., black-tailed prairie dog) (MNHP et al. 2006).

In recent years (1995 to 2006), breeding ferruginous hawks have been observed in the planning area at the Medicine Lake National Wildlife Refuge; Charles M. Russell National Wildlife Refuge; near Forsyth, Ingomar, Alzada, Locate, Westby, and Powderville, Montana; and in east Fallon County (MNHP et al. 2006); but there are no records for wintering ferruginous hawks within the planning area during this period. As of 2006, 356 ferruginous hawk nest sites were reported, including 144 on BLM-administered land.

The Swainson's hawk *(Buteo swainsoni)* breeds throughout Montana, nesting in river-bottom forests, brushy coulees, and shelterbelts, and hunting in grasslands and agricultural areas, particularly along river bottoms (MFWP and MNHP 2006). Main threats to the species include loss of nesting and foraging habitat and disturbance at nest sites (MNHP et al. 2006). In recent years (1999 to 2009), breeding Swainson's hawks were observed in the planning area at Medicine Lake National Wildlife Refuge; in Carter County, northeast Sheridan County, and Fallon County as well as near Redstone, Westby, Fort Peck, Powderville, Melstone, Savage, Oswego, Circle, Ingomar, Jordan, and Decker, Montana (MNHP et al. 2009). Only 26 Swainson's hawk nest sites have been reported in the planning area and only 2 of these occurred on BLM-administered land.

Peregrine falcons *(Falco peregrines)* typically nest in cliff areas near water and abundant bird prey. Following implementation of successful management activities (restrictions of organochlorine pesticides in the United States and Canada), the species was removed from the federal list of threatened and endangered species in 1999 (USFWS 1999a; Abbitt and Scott 2001). In recent years (1995 to 2006), breeding peregrine falcons have been observed at one location (Big Island in the Medicine Lake National Wildlife Refuge) in the planning area, with additional sightings of non-breeding peregrines in the same area and other areas in Sheridan and Roosevelt counties (MNHP et al. 2006). There are no known peregrine falcon nest sites in the planning area.

Northern goshawk *(Accipiter gentilis)* breeding habitat consists primarily of mature and old growth coniferous forest with high canopy closure, but their habitat requirements and winter activities in Montana are not well understood (MFWP and MNHP 2006). Timber harvest and nest site disturbance are primary threats to the species. In recent years (1995 to 2006), breeding goshawks have been documented at three locations in the planning area (Powder River, Garfield, and Custer counties) with one documented winter sighting between Savage and Sidney, Montana (MNHP et al. 2006). There are four reported northern goshawk nest sites in the planning area (three were documented earlier than 1984).

Sage thrashers *(Oreoscoptes montanus)* prefer relatively dense stands of tall sagebrush for nesting. Primary threats to the species include habitat loss and degradation from livestock grazing, agriculture, mining, and other development. In recent years (1999 to 2009), observations of breeding sage thrashers have been documented in the planning area near Nelson and Ingomar, Montana, as well as in Rosebud, Garfield, Richland, Custer, Rosebud, Big Horn, and Powder River counties (MNHP et al. 2009).

Preferred breeding habitat for sedge wrens *(Cistothorus platensis)* includes wetlands and adjacent areas highly susceptible to flooding and drying (MFWP and MNHP 2006). As with other wetland-associated birds, habitat loss and degradation are the primary threats to these birds. In recent years (1999 to 2009), breeding sedge wrens have been documented in the planning area near Westby and Bainville, Montana, and in Sheridan County (MNHP et al. 2009).

Loggerhead shrikes *(Lanius ludovicianus)* use a wide variety of open habitats (e.g., sagebrush shrubland and shrub-steppe, grasslands, badlands, pastures, and agricultural fields with scattered trees or shrubs for nesting), as long as woody nesting strata (often thorny shrubs) are available (Montana Partners in Flight 2000). Primary threats to the species include loss of breeding habitat and health effects because of pesticide use (Montana Partners in Flight 2000). In recent years (1999 to 2009), breeding loggerhead shrikes were documented throughout the planning area including areas near Forsyth, Locate, Savage, and Circle, Montana, and Charles M. Russell National Wildlife Refuge (MNHP et al. 2009).

Preferred breeding habitat for the chestnut-collared longspur *(Calcarius ornatus)* is native grasslands, but the species also uses grazed grasslands and hayfields, usually avoiding cultivated fields (Montana Partners in Flight 2000). Primary threats to the species include habitat conversion and overgrazing. In recent years (1995 to 2006), breeding chestnut-collared longspurs have been documented in the planning area at Medicine Lake National Wildlife Refuge; in northeast Sheridan County and Valley County; and near Dagmar, Circle, Powderville, Webster, Locate, Savage, Oswego, and Ingomar (MNHP et al. 2006).

The McCown's longspur *(Calcarius mccownii)* prefers grasslands with low vegetation cover, such as true native short-grass prairie or heavily grazed mixed-grass prairie (Montana Partners in Flight 2000); but the species may also use cultivated lands. Threats include habitat loss on breeding grounds and undetermined factors on wintering grounds. In recent years (1999 to 2009), breeding McCown's longspurs have been documented in the planning area near Circle and observations have been recorded in Daniels, McCone, and Garfield counties (MNHP et al. 2009).

The Baird's sparrow *(Ammodramus bairdii)* is associated with grasslands, particularly native prairie (Montana Partners in Flight 2000); the primary threat is the conversion of this habitat to cropland. In recent years (1999 to 2009), breeding Baird's sparrows have been documented in the planning area at Medicine Lake and Lamesteer National Wildlife Refuges as well as near Westby, Tour, Oswego, Powderville, Savage, and Webster, Montana

(MNHP et al. 2009). Observations of Baird's sparrows have been made in McCone, Carter, Dawson, Richland, Roosevelt, Daniels, Sheridan, Powder River, and Rosebud counties (MNHP et al. 2009).

Habitat for Brewer's sparrows *(Spizella breweri)* is predominantly sagebrush (MNHP et al. 2006; MNHP and MFWP 2006), and primary threats to the species include habitat loss, including the degradation of sagebrush through heavy grazing and other factors (MNHP et al. 2006). In recent years (1999 to 2009), breeding Brewer's sparrows have been documented in the planning area in every county except Roosevelt and Daniels, including near Locate, Melstone, Savage, Brusett, Powderville, Brandenberg, Ingomar, and Decker, Montana (MNHP et al. 2009).

LeConte's sparrow *(Ammodramus leconteii*) is primarily a bird of the northern Great Plains and central Canadian provinces; preferred breeding habitat includes wet meadows and tall grasslands near wetlands or streams (Montana Partners in Flight 2000). LeConte's sparrows breed in the extreme northeast corner (near Westby) of Montana, in Roosevelt and Sheridan counties, as well as a few sedge meadows in and near the western edge of Glacier National Park (Montana Partners in Flight 2000; MNHP et al. 2009).

Nelson's sharp-tailed sparrows *(Ammodramus nelson)* nest in grasslands, marsh edges, and herbaceous wetlands (Montana Partners in Flight 2000), and northeast Montana represents the periphery of the species' range. Habitat loss and degradation due to livestock grazing are primary threats to the species (Montana Partners in Flight 2000; MNHP et al. 2006). In recent years (1999 to 2009), breeding Nelson's sharp-tailed sparrows have been documented in the planning area at Round Lake and Widgeon Slough, Big Slough, and Stateline Waterfowl Production Areas and near Westby, Homestead, Flaxville, Plentywood, Bainville, and Comertown, Montana (MNHP et al. 2009).

Birds, Greater sage-grouse

The greater sage-grouse occurs across 11 Western states, including portions of the planning area. Based on available genetic and ecological data, the USFWS determined that the western subspecies was not a valid subspecies; subsequently, it is considered a single species across its range (2005d). In cooperation with MFWP, the University of Montana, and the Adopt-A-Lek Program, the BLM is working towards gaining a better understanding of the genetic connectivity of groups of sage-grouse across their Montana range. Genetic testing from feather samples can be used to determine consanguinity of birds within and between lek complexes or designated core habitats (Map 2). Similar testing is underway in North Dakota, South Dakota, and Wyoming.

In a 2005 status review of the greater sage-grouse, USFWS determined that the greater sage-grouse was not warranted for listing under the ESA given the generally improving population trends, existing habitat availability, and large species range (USFWS 2005d). A 2007 decision by Chief U.S. District Judge B. Lynn Winmill remanded the 2005 decision back to the USFWS for reconsideration. The USDI, in conjunction with a finding by USFWS, announced in March of 2010 that, based on accumulated scientific data and new, peer-reviewed information and analyses, the greater sage-grouse warrants the protection of the ESA but that listing of the species was precluded by the need to first address higher priority species (USFWS 2010a). Subsequently, the greater sage-grouse will be placed on the candidate list for future action, which means that the species will not receive statutory protection under the ESA and states will continue to be responsible for sage-grouse management. The USFWS will evaluate this decision annually to consider conditions and determine whether the listing priority should be adjusted.

As directed by BLM Instruction Memorandum (IM) No. MT-2010-017, development of Sage-grouse Habitat-General Habitat Areas, Sage-grouse Habitat – Protection Priority Areas, and Sage-grouse Habitat – Restoration Areas were developed utilizing an interdisciplinary planning team (BLM 2009c). Criteria for proposed Protection Priority Areas and Restoration Areas included BLM-administered lands, sage-grouse lek locations, existing and potential surface-disturbing activities, digital elevation models, various datasets, and other factors. It should be noted that, although nonnative habitats exist within these areas and not all habitats within the designated areas are sagebrush habitat, these designations provide a landscape-level approach needed to maintain sustainable sage-grouse populations. In addition, an identified source population area within a Sage-grouse Habitat – Restoration Area (in the Cedar Creek Anticline portion of the planning area) that contains a small population of sage-grouse and low existing energy development has been proposed in this RMP. The objective is to maintain remnant populations to enable future translocations and maintain connectivity between habitat areas. See the *Fish and Wildlife Appendix* for more information.

Specific objectives for sage-grouse that include maintaining and increasing, where possible, present distribution and abundance of sage-grouse are addressed in the Greater Sage-grouse Comprehensive Strategy MOU to which BLM was a signatory (Stiver et al. 2006). The BLM's *National Sage-grouse Conservation Strategy* (BLM 2004i) and the statewide *Management Plan and Conservation Strategies for Sage Grouse in Montana* (Montana Sage Grouse Work Group 2005) are the primary guides for current management of sage-grouse habitat on BLM-administered lands. Both plans provide broad goals for sage-grouse conservation, management, and specific actions to accomplish these goals. The BLM is an active participant in the Montana Sage Grouse Work Group, a cooperative membership of state, federal, tribal, and private entities and several individuals from the general public that developed the statewide plan. See the *Fish and Wildlife Appendix* for more information.

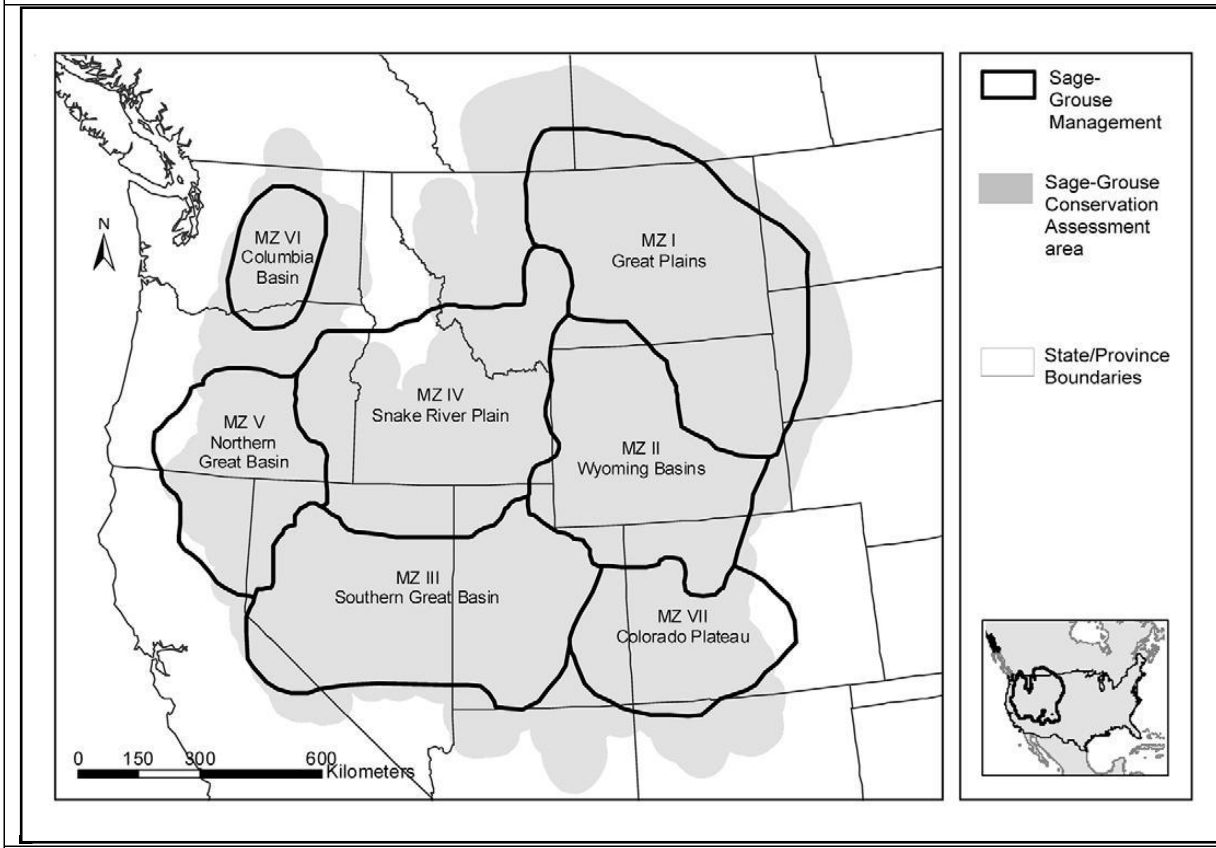
As part of the BLM's December 2011 *National Greater Sage-Grouse Land Use Planning Strategy*, transmitted via Washington IM 2012-044, the BLM is preparing amendments to formal land use plans to further govern management of sage-grouse on BLM-administered lands. The BLM needs to incorporate explicit objectives and adequate conservation measures into RMPs within the next 3 years to conserve greater sage-grouse and potentially reduce the need to list under the ESA. The planning strategy will evaluate the adequacy of BLM RMPs and address, as necessary, revisions and amendments throughout the range of the greater sage-grouse in North America, which has been divided into seven sage-grouse management zones based on populations within floristic provinces (Stiver et al. 2006) (Figure 3-9). The floristic provinces are areas within which similar environmental factors influence vegetation communities (Knick and Connelly 2011a). Management Zone 1, which is part of the Rocky Mountain Region of this planning effort, includes this RMP's planning area.

Sage-grouse are native to the sagebrush steppe of western North America, and their distribution closely follows that of sagebrush, primarily big sagebrush (Montana Sage Grouse Work Group 2005). The importance of mature sagebrush with a good understory of grasses and forbs is well documented. In eastern Montana, where close interspersion of wintering, nesting, breeding, and brood-rearing habitat rarely require large seasonal movements, sage-grouse are essentially non-migratory.

The sagebrush ecosystem is representative of the struggle to maintain biodiversity in a landscape that bears the debt of ever-increasing demands for natural resources. A gallinaceous species native only to western semiarid sagebrush habitats, sage-grouse were previously widespread before loss and degradation of sagebrush habitat resulted in extirpation of the species from almost half of its original range (Schroeder, Young, and Braun 1999; Schroeder et al. 2004). Sage-grouse populations continue to decline by 2 percent annually (Connelly, Knick, Schroeder, Stiver, and WAFWA 2004). In Montana, the sage-grouse population declined sharply from 1991 to 1996 before increasing through 2000 (Montana Sage Grouse Work Group 2005). MFWP Region 7, which includes most of the MCFO RMP planning area, 2010 lek data shows 386 leks of unconfirmed status (single count with no subsequent survey or reported without survey data), 455 confirmed active leks (existence supported by data), 33 extirpated leks (permanently abandoned), and 19 confirmed inactive leks (data supports evidence of 10 or more years with no males or signs of activity) (Beyer, Foster, and Denson 2010). Four MFWP trend areas, which are scattered throughout the planning area, with a total of 80 sage-grouse leks are counted annually in MFWP's Region 7. The total males counted in these trend areas peaked in 2006 with 988 males. The number of males counted on trend areas declined from 2007 to 2009 but increased in 2010. The overall trend for the sage-grouse trend areas is stable (Beyer et al. 2010).

In portions of Sage-grouse Management Zone 1, sage-grouse populations have declined through wholesale loss of habitat and through impacts of disturbance and direct mortality to birds on the remaining habitat. The most pervasive and extensive change to the sagebrush ecosystems in Sage-grouse Management Zone 1 is the conversion of nearly 60 percent of native habitats to agriculture (Samson et al. 2004). The conversion was facilitated by the Homestead Act of 1862 in the United States and the Canada Dominion Act of 1872 (Knick 2011). Under the Homestead Act, nearly 1.5 million people acquired and plowed over 309,000 square miles (800,000 square kilometers) of land, primarily in the Great Plains (Samson et al. 2004). The impacts of land conversion in the late 1800s and early 1900s were probably greatest for sagebrush habitats nearest perennial water sources in Management Zone 1.

FIGURE 3-9.
BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Source: Knick and Connelly 2011a

In Sage-grouse Management Zone 1, greater sage-grouse were a historically a function of the interaction of physical factors (e.g., climate, soils, geology, and elevation), and natural disturbance factors (e.g., fire, grazing, and drought) that allowed sagebrush to persist on the landscape. These physical and natural factors combined to produce an interspersion and juxtaposition of different habitats that included large expanses of sagebrush patches favorable for greater sage-grouse occupation. The sagebrush species associated with greater sage-grouse habitat in Sage-grouse Management Zone 1 is primarily Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*). Overall shrub cover is less than 10 percent in these areas, which may include basin big sagebrush (*Artemisia tridentata ssp. tridentata*), silver sagebrush (*Artemisia cana*), greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* species), rubber rabbitbrush (*Ericameria nauseosa*), green rabbitbrush (*Chrysothamnus viscidiflorus*), and antelope bitterbrush (*Purshia tridentata*) (MNHP 2012). Perennial herbaceous components in these habitat types, consisting mostly of rhizomatous and bunch-form grasses with a diversity of perennial forbs, typically contribute greater than 25 percent vegetative cover (MNHP 2012). The dominant grass in this system is western wheatgrass (*Pascopyrum smithii*) but sites may include other species such as Indian ricegrass (*Achnatherum hymenoides*), blue grama (*Bouteloua gracilis*), Sandberg's bluegrass *(Poa secunda*), or bluebunch wheatgrass (MNHP 2012). In Montana and Wyoming, dryland sedges such as threadleaf sedge (*Carex filifolia)* and needleleaf sedge (*Carex duriuscula*) are very common and important in the eastern distribution of this system (MNHP 2012). Common forbs include Hood's phlox (*Phlox hoodii*), sandwort (*Arenaria* species), prickly pear (*Opuntia* species), scarlet globemallow (*Sphaeralcea coccinea*), purple prairie clover (*Dalea purpurea*), gayfeather (*Liatris punctata*), and milkvetch (*Astragalus* species) (MNHP 2012). Big sagebrush is easily killed by fire at all intensities and does not resprout when exposed to fire

(MNHP 2012). In southwestern Montana, fire in big sagebrush occurs at the stand-replacing level, which kills or removes most of the aboveground vegetation, and recovery to pre-burn cover (of sagebrush) takes at least 20 years (MNHP 2012). MNHP (2012) reports that Wyoming big sagebrush in Montana may require a century or longer to recover from fire. Big sagebrush occurs on level to gently rolling plains, plateaus, sideslopes and toeslopes, and as small and large patches in dissected landscapes such as breaks (MNHP 2012).

Throughout Sage-grouse Management Zone 1, land ownership is predominantly private (70 percent). Ownership of the remaining range of the greater sage-grouse in Sage-grouse Management Zone 1 is 68 percent private and 13 percent state or other federal ownership (not including the Fort Peck and Fort Belknap Indian Reservations), with 83 percent of the federal lands in the range of greater sage-grouse in Management Zone 1 managed by the BLM.

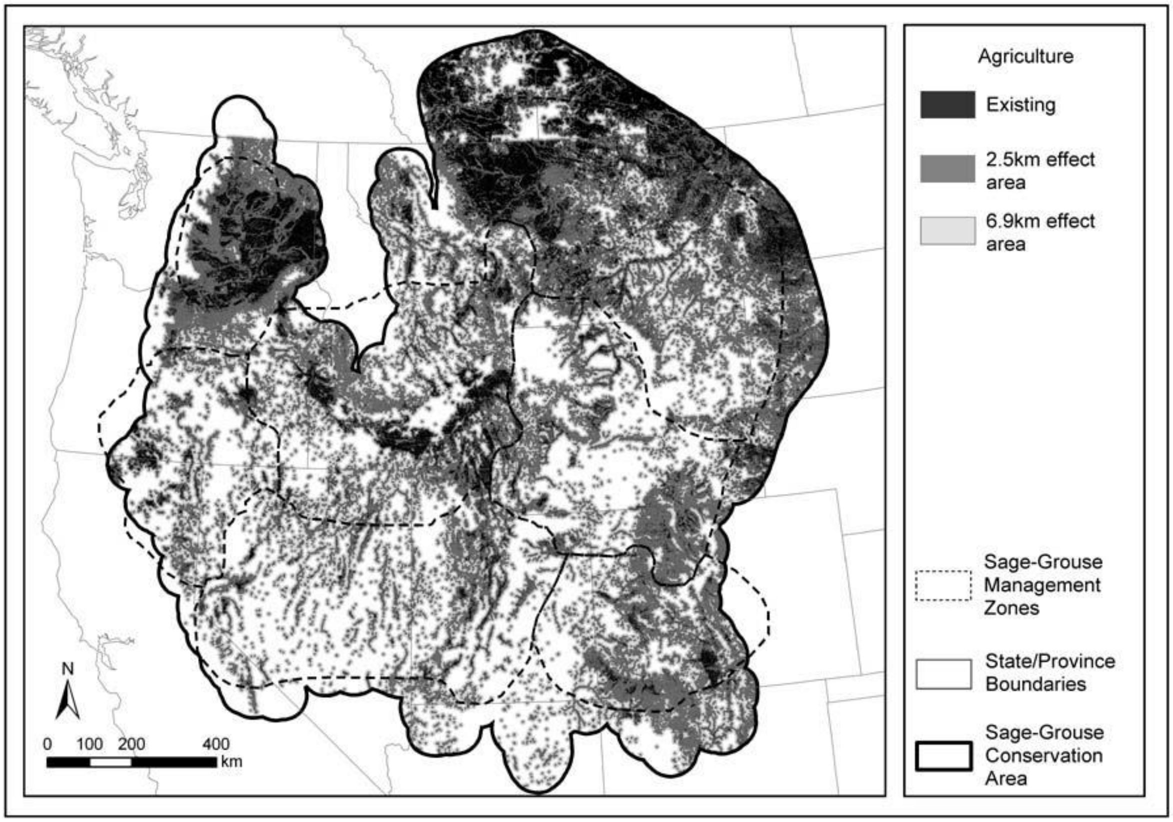
Primary ongoing threats to sage-grouse include habitat loss, fragmentation, and deterioration as a result of factors including the spread of invasive species, infrastructure development, rapidly expanding energy development, wildfire, conversion of sagebrush habitats to nonnative species or agriculture, and conifer invasion (USFWS 2005d), which occurs throughout the planning area. (See the *Minerals* section for current numbers of oil and gas wells.) There are approximately 16.9 million acres of sage-grouse habitat in the planning area, including approximately 2.5 million acres (15 percent) on BLM-administered lands (MFWP 2010a). The distribution and influence of multiple land uses such as energy development, ROWs, and livestock grazing varies across sage-grouse distribution (Knick et al. 2003) throughout the planning area. Conversion to cropland has eliminated or fragmented sagebrush on private lands in areas with deep fertile soils or irrigation potential, and sagebrush remaining in these areas has been limited to agricultural edge or relatively unproductive environments. Oil and gas resources are being developed primarily in the eastern portion of the sage-grouse range in the planning area. Wind exploration and development is occurring in the planning area (wind turbines were recently constructed in the Cedar Creek Anticline).

In Sage-grouse Management Zone 1, native vegetation currently covers about 59 percent of the management zone, with approximately 25 percent of the remaining native vegetation managed by the BLM. Much of the direct habitat loss from conversion to agriculture has occurred primarily in the far northwestern and northeastern portions of the management zone (Knick et al. 2011). Cropland currently covers nearly 19 percent of Sage-grouse Management Zone 1 and 91 percent of Sage-grouse Management Zone 1 is within 6.9 kilometers of cropland (Knick et al. 2011) (Figure 3-10). Recent interest in bio-fuel production and high prices for small grains has resulted in an increase in the conversion of native grasslands or lands formerly enrolled in the CRP to cropland, further emphasizing the importance of BLM-administered lands and associated private lands managed for grazing in maintaining large blocks of native grassland and shrubland habitats.

Converting native grasslands to agricultural lands not only resulted in a direct loss of habitats for native wildlife, it began a process of habitat fragmentation. Habitat loss is exacerbated when fragmentation reduces the size or isolates remaining habitat patches below the size thresholds necessary to support components of biological diversity or when it blocks the movement of animals between habitat patches. As large contiguous blocks of habitat are dissected into smaller blocks, they became more isolated from one another by dissimilar habitats and land uses. Adverse impacts from fragmentation can occur to individual plant and animal species and communities. The impacts of habitat fragmentation to biological resources can occur on multiple scales and can vary by species and the type of fragmentation. Individual species have different thresholds of fragmentation tolerance; greater sage-grouse have large spatial requirements and eventually disappear from landscapes that no longer contain large enough patches of habitat while smaller birds like the Sprague's pipit can persist in landscapes with smaller patches of habitat because their spatial requirements are smaller.

Changes in vegetation can also result in the loss and fragmentation of native habitats. The conversion of large acreages of sagebrush to predominately grassland communities results in the direct loss of sagebrush habitat and can fragment remaining habitat for sagebrush-dependent species, such as the greater sage-grouse. Roads and OHV use can promote the spread of invasive species (weeds) through vehicular traffic, and weed infestations can further exacerbate the fragmentation effects of roadways. Irrigation water has also supported the conversion of native plant communities to hayfields, pasture, and cropland, thus fragmenting sagebrush habitats. Excessive grazing in these habitats can lead to the demise of the most common perennial grasses in this system and an abundance of cheatgrass or Japanese brome (MNHP 2012).

FIGURE 3-10.
AGRICULTURAL LANDS IN BLM SAGE-GROUSE MANAGEMENT ZONES



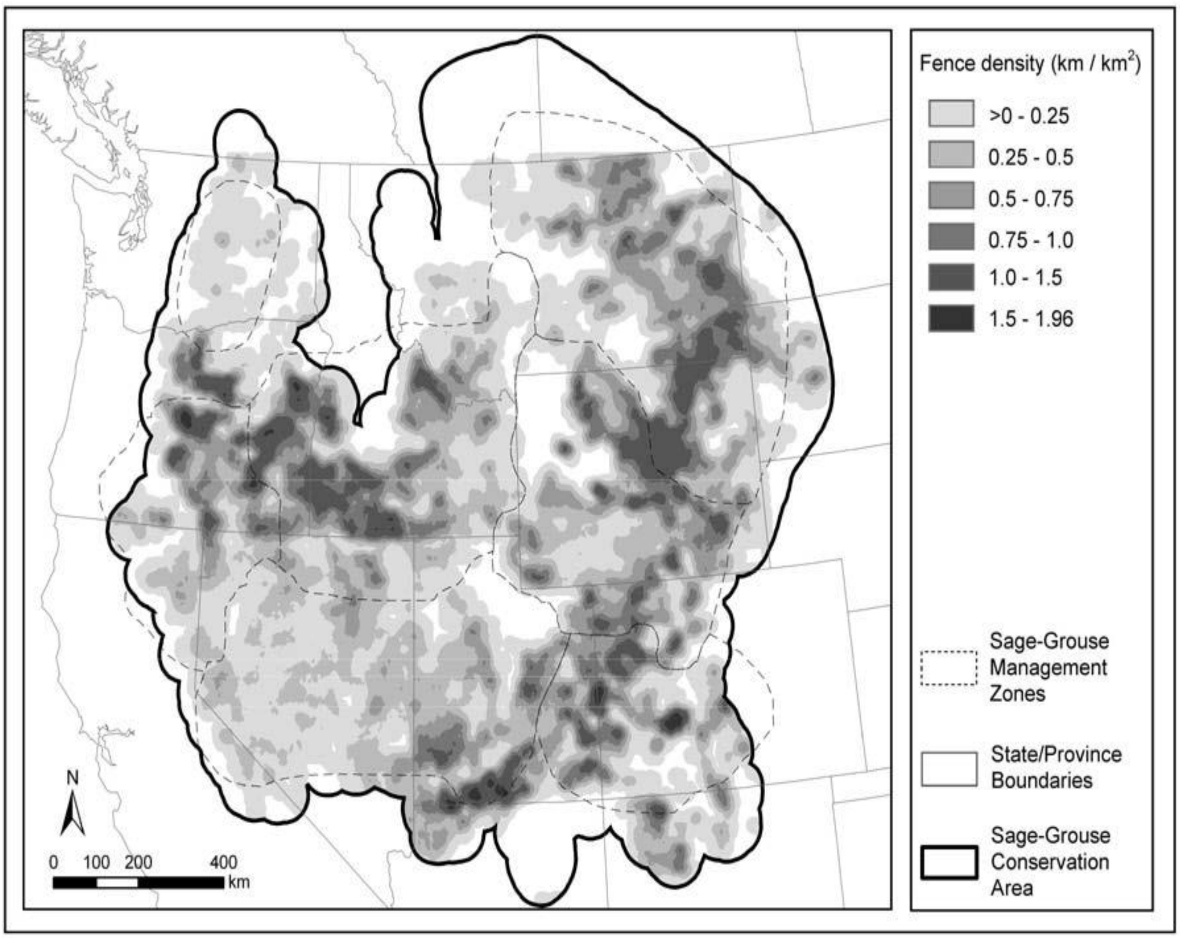
Source: Knick et al. 2011
Mapped land cover depicts primarily croplands although pasture was included in the agriculture category

In Sage-grouse Management Zone 1, the remaining sagebrush habitats are mostly managed as grazing lands for domestic livestock. Domestic livestock function as a keystone species in the management zone through grazing and management actions related to grazing. Although these actions do not preclude wildlife and vegetation, they do influence ecological pathways and species persistence (Bock, Bock, and Smith 1993).

The effects of grazing on sagebrush habitats in this management zone are much different from effects noted in the Great Basin since the landscape throughout Management Zone 1 is adapted to withstand grazing disturbance (Knick et al. 2011). Historically, large numbers of bison moved nomadically through the management zone in response to changes in vegetation associated with drought, past grazing, and fire. Grazing by bison occurred in large areas as huge herds moved through and the impacts of these herds on the vegetation, soils, and riparian areas were probably extensive. The interval between grazing episodes may have ranged from 1 to 8 years (Malainey and Sherriff 1996). Bison were replaced with domestic livestock in the late 1800s. The intensity and duration of grazing in the management zone increased as domestic livestock numbers and annual grazing pressure increased. The high-intensity grazing probably increased the density and perhaps the distribution of sagebrush in the management zone, particularly when combined with a concurrent reduction in fire on the landscape.

Grazing on public lands was unregulated until the passage of the Taylor Grazing Act in 1934. Since the passage of the Taylor Grazing Act, range conditions have improved through improved grazing management practices and livestock operations related to decreased livestock numbers and the annual duration of grazing. In addition, the BLM has applied Standards for Rangeland Health since 1997 to enhance sustainable livestock grazing and wildlife habitat while protecting watersheds and riparian ecosystems. However, developments to facilitate grazing management often include elements detrimental to sage-grouse. Perhaps the most pervasive change associated with grazing management in sage-grouse habitats throughout the management zone is the construction of fencing and water developments (Knick et al. 2011) (Figure 3-11). Barbed wire fences contribute to direct mortality of sage-grouse through fence collisions (Stevens 2011) and water developments may contribute to increased occurrence of West Nile virus in greater sage-grouse (Walker and Naugle 2011). Water developments are particularly prevalent in the north-central portion of Sage-grouse Management Zone 1 (Figure 3-12). Additional habitat modifications associated with grazing management include mechanical and chemical treatments to increase grass production, often by removing sagebrush (Knick et al. 2011).

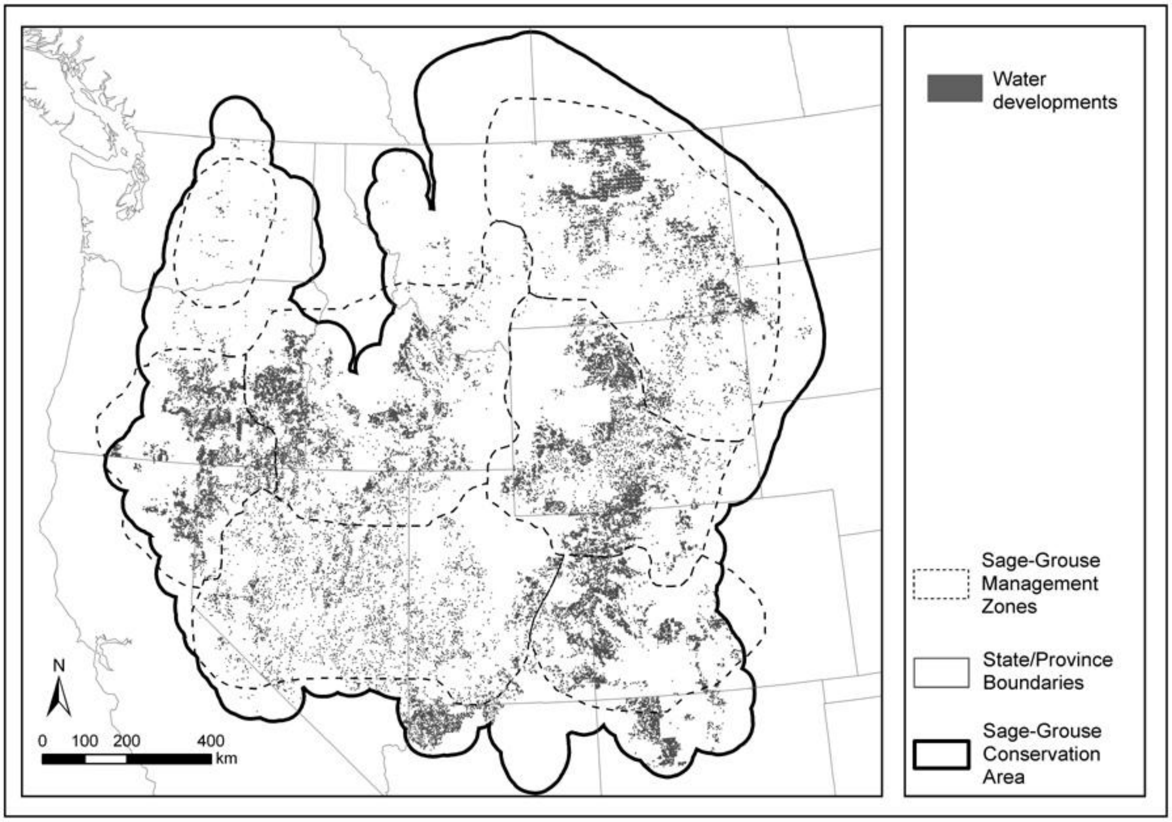
FIGURE 3-11.
LINEAR FENCE DENSITY ON PUBLIC LANDS IN BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Knick et al. 2011
Linear density (kilometers per kilometers^2) of fences (estimated from allotment and pasture boundaries) on public lands in the Sage-grouse Conservation Area

In Sage-grouse Management Zone 1, other major land uses include energy development (primarily oil and gas development), urbanization, and infrastructure. Oil and gas development in the management zone has occurred throughout Sage-grouse Management Zone 1 but is concentrated in the southern portions (PRB) the north (Bowdoin Field) and the south and east (Williston Basin) (Figure 3-13). Oil and gas development includes direct loss of habitat from well pad and road construction as well as indirect disturbance impacts from increased noise and vehicle traffic. Oil and gas developments directly impact greater sage-grouse through avoidance of infrastructure or impacts to survival or reproductive success. Indirect effects include changes to habitat quality, predator communities, or disease dynamics (Naugle, Doherty, Walker, Holloran, and Copeland 2011).

FIGURE 3-12.
WATER DEVELOPMENTS ON BLM-ADMINISTERED LANDS IN BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Knick et al. 2011
Locations of water development are recorded to the nearest 2.59 kilometers^2

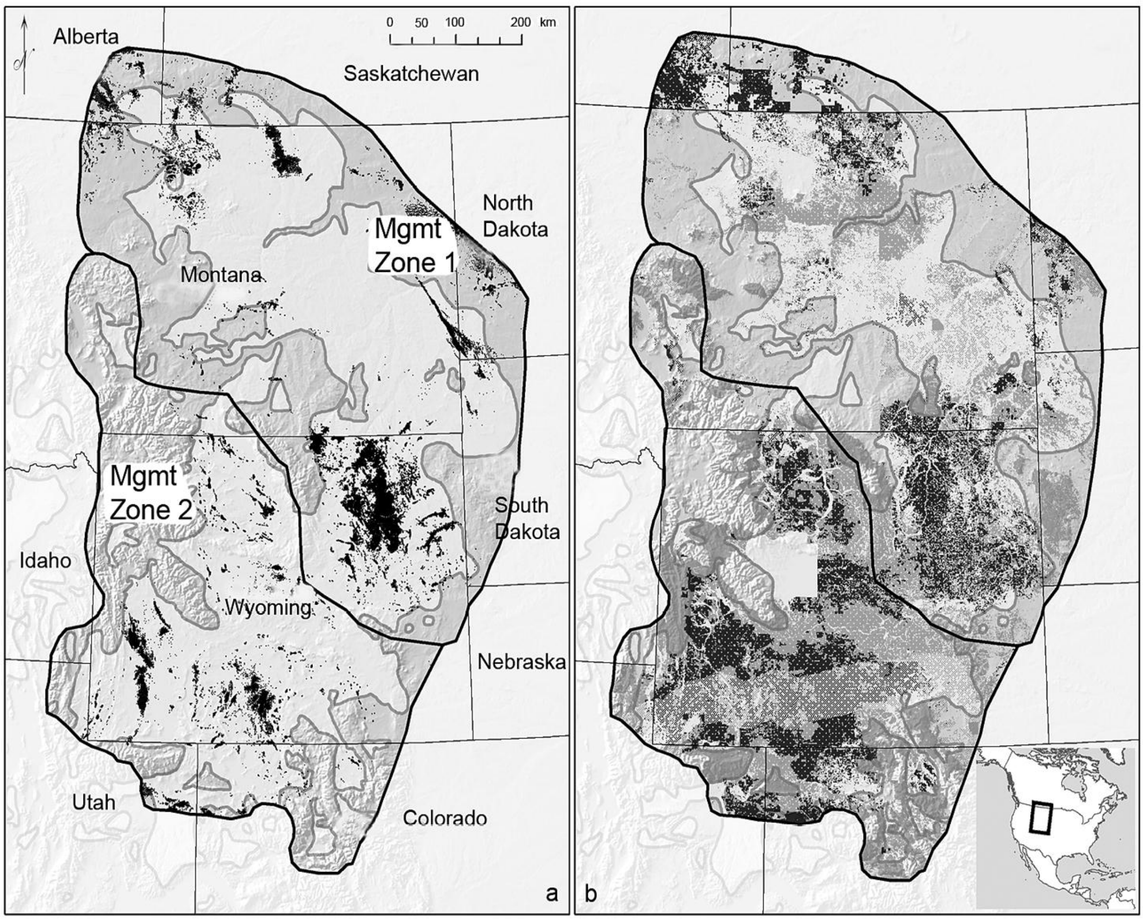
Expanding energy development in western North America poses a major new challenge for sage-grouse conservation. Greater sage-grouse and other sagebrush-obligate species are experiencing a “death by a thousand cuts” scenario. Past major reviews argued (Schroeder et al. 1999; Knick, Dobkin, Rotenberry, Schroeder, Vander Hagen, and van Riper III 2003; Crawford et al. 2004) and recent studies confirm (Holloran and Anderson 2005b; Walker, Naugle, and Doherty 2007; Doherty 2008) that sage-grouse are landscape specialists requiring large and intact sagebrush habitats to maintain populations. Several studies have shown that breeding sage-grouse populations are severely affected at oil and gas well densities commonly permitted in Montana and Wyoming (Naugle, Doherty, Walker, Copeland, Holloran, and Tack 2011).

Doherty, Naugle, and Evans (2010) found that, although impacts were indiscernible at densities of less than 1 well per square mile, lek losses were 2 to 5 times greater in areas with development above this threshold than those occurring outside of these areas, and abundance (males per lek) at the remaining leks declined by approximately 30 to 80 percent (Doherty et al. 2010). These and other studies demonstrate that both direct and indirect impacts result from the impacts of energy development and geophysical exploration.

Several studies have quantified the distance from leks at which impacts of development become negligible and assessed the efficacy of BLM NSO stipulations for leasing and development within 0.25 miles of a lek (Holloran 2005; Walker et al. 2007). Walker et al. (2007) found that buffer sizes of 0.25, 0.5, 0.6, and 1.0

miles resulted in an estimated lek persistence (the ability of leks to remain on the landscape) of approximately 5, 10, 15, and 30 percent while lek persistence in areas without oil and gas development averaged approximately 85 percent.

FIGURE 3-13.
LOCATIONS OF PRODUCING WELLS AND LEASES, SAGE-GROUSE RANGE, AND MINERAL ESTATE IN BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Knick et al. 2011
a) Locations of producing oil and gas wells within Sage-grouse Management Zones I and II (Connelly et al. 2004); range of greater sage-grouse (Schroeder et al. 2004) within management zones is shown in gray.
b) Federal mineral estate is shown in gray and authorized leases on the federal mineral estate in the United States and Canada are shaded black.
Leases were authorized for exploration and development on or before 1 June 2007 for each state except Utah (1 May 2007). Leases in Canada were authorized for development on or before 29 January 2008 in Saskatchewan and 4 April 2008 in Alberta. A swath of authorized leases across southern Wyoming appears lighter in color because mineral ownership is mixed.

Naugle et al. (2011) reported that impacts of energy development had been documented to distances greater than 3.5 miles from the lek, and Holloran (2005) found impacts to abundance at a distance between 3 and 4 miles. However, Naugle et al. (2011) also stated that impacts to leks caused by energy development were found to be the most severe near the lek.

Nearly 16 percent of Sage-grouse Management Zone 1 is within 3 kilometers of oil and gas wells, a distance in which ecological impacts are likely to occur (Knick et al 2011). Much of the current oil and gas development is occurring on private lands with little or no mitigation efforts, which elevates the ecological and conservation importance of sage-grouse habitat on public lands.

Naugle et al. (2011) found that impacts from energy development often result in the extirpation of leks within gas fields. Holloran (2005) demonstrated that lek counts (a reasonable index to population abundance and trends [Reese and Bowyer 2007]) decreased as the distance to the nearest active drilling rig, producing well, or main haul road decreased. Doherty (2008) documented that lek losses increased and male abundance decreased as well density increased. Lek extirpation in areas with 8 wells per section (40 to 100 wells) within 2 miles of the lek was 5 times more likely to occur than in areas with no wells within 2 miles, and male attendance at the remaining leks in these areas declined approximately 20 to 60 percent (Doherty 2008). Walker et al. (2007) demonstrated that 0.25-mile NSO lease stipulations are insufficient to conserve breeding sage-grouse populations in a typical landscape in the PRB (a portion of which is located in the planning area) because nearly 100 percent of the area within approximately 2 miles of leks remains open to full-scale development.

Noise associated with disruptive activities impact numerous wildlife species, including sage-grouse and associated sagebrush obligates. Sage-grouse are known to select highly visible leks with good acoustic properties. Sage-grouse numbers on leks within approximately 1 mile of CBNG compressor stations in Campbell County, Wyoming, were consistently lower than numbers on leks unaffected by this disturbance (Braun, Oedekoven, and Aldridge 2002). Holloran and Anderson (2005b) reported that lek activity by sage-grouse decreased downwind of drilling activities, suggesting that noise caused measurable impacts on sage-grouse.

In addition to activities directly associated with oil and gas development, traffic associated with roads also generates noise. Knick et al. (2003) indicated that there were no active sage-grouse leks within approximately 1 mile of Interstate 80 across southern Wyoming and only 9 leks known to occur between approximately 1 and 2.5 miles of Interstate 80. Lyon and Anderson (2003) reported that oil and gas development influenced the rate of nest initiation of sage-grouse in excess of approximately 2 miles of construction activities. As these studies show, the level and frequency of noise associated with development causes major impacts to greater sage-grouse. Consequently, all drilling activities for gas and oil development should be prohibited within approximately 3.5 miles of active leks and their associated nesting areas (Holloran 2005). Further, all existing and new compressor stations should add noise abatement devices (mufflers) to reduce audible noise within approximately 3.5 miles of active leks. Noise thresholds on or near greater sage-grouse breeding and nesting activities is unknown.

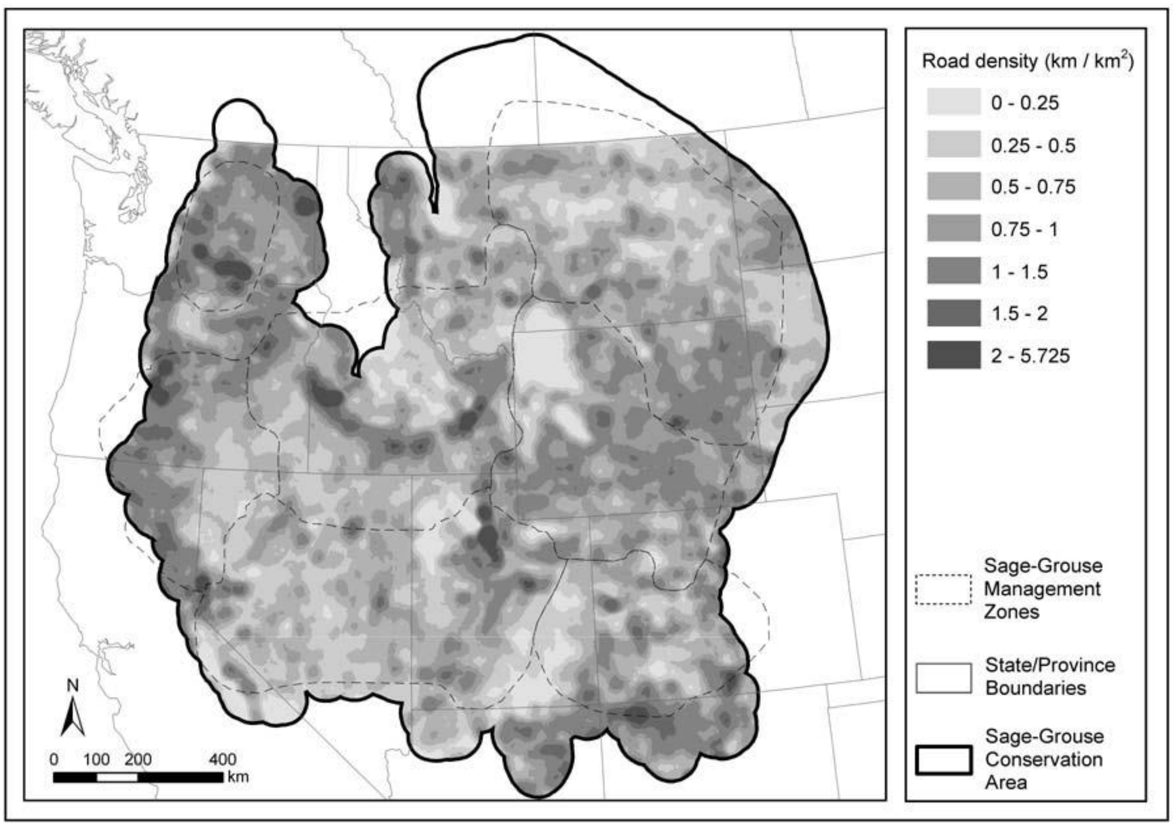
It should be noted that median noise levels for rural areas would likely range from 20 to 40 dBA in the morning and evening and from 50 to 60 dBA in the afternoon (when wind speeds typically would be the greatest) (TRC Mariah Assoc. 2005). Additional information from a noise study near Pinedale, Wyoming, indicated that mean noise levels near sage-grouse leks were between 24 and 32 dBA (KC Harvey Consult. 2009). Other BLM record of decision (ROD) documents define baseline noise levels of 39 dBA based on settings similar to those of the USEPA's category of "Farm in Valley" (BLM 2008g).

In Sage-grouse Management Zone 1, urbanization and infrastructure development has also affected greater sage-grouse habitat. Development at population centers and subdivisions or smaller ranchettes and associated buildings, roads, fences, and utility corridors has also contributed to habitat loss and fragmentation in portions of the Sage-grouse Management Zone 1. Current estimates suggest about 16 percent of the management zone is within 6.9 kilometers of urban development, although Sage-grouse Management Zone 1 generally has lower population densities and lower rates of population increases compared to the other management zones (Knick et al 2011). Impacts of infrastructure development to greater sage-grouse habitats in Sage-grouse Management Zone 1 are primarily related to highways, roads, power lines and communication towers, with nearly 92 percent of Sage-grouse Management Zone 1 within 6.9 kilometers of a road, 32 percent within 6.9 kilometers of a power line, and 4 percent within 6.9 kilometers of a communication tower (Knick et al. 2011) (Figure 3-14). Increased recreation and OHV use on lands in Sage-grouse Management Zone 1 are also thought to impact greater sage-grouse habitats but have not been studied (Knick et al. 2011).

Greater sage-grouse strutting at lek in the planning area

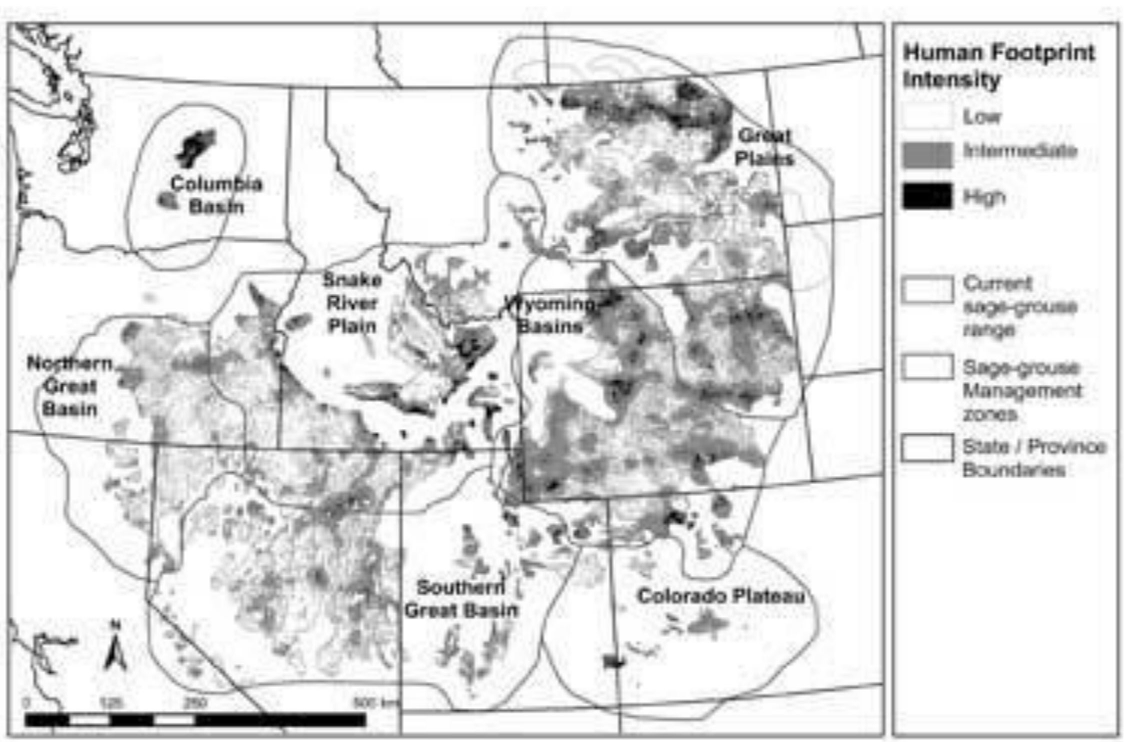
In Sage-grouse Management Zone 1, the cumulative and interactive impact of multiple disturbances and habitat loss has influenced the current distribution of greater sage-grouse. The cumulative extent of human-caused changes (the human footprint) on sage-grouse habitat in Sage-grouse Management Zone 1 is highest at the northern edge of Sage-grouse Management Zone 1 but occurs throughout Sage-grouse Management Zone 1 (Leu and Hanser 2011) (Figure 3-15). Population centers for greater sage-grouse in Sage-grouse Management Zone 1 (Doherty, Naugle, Copeland, Pocewicz, and Kiesecker 2011) generally correspond to areas lacking a high human footprint, and some of these areas have been designated as core areas by MFWP (MFWP 2012). The greater sage-grouse range in Sage-grouse Management Zone 1 is very similar overall to portions of the range in which sage-grouse have been extirpated already (i.e., areas with high human footprints), mostly because of the abundance and distribution of sagebrush occurring in Sage-grouse Management Zone 1 (Wisdom, Meinke, Knick, and Schroeder 2011), which suggests that sage-grouse in Sage-grouse Management Zone 1 are more vulnerable to declines than those in other portions of the sage-grouse range.

FIGURE 3-14.
CONTOURED SECONDARY ROADS IN BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Knick et al. 2011
Density (kilometers per kilometers²) within an 18-kilometer radius

FIGURE 3-15.
SPATIAL EXTENT OF THREE HUMAN-FOOTPRINT-INTENSITY CLASSES FOR THE CONTERMINOUS UNITED STATES IN BLM SAGE-GROUSE MANAGEMENT ZONES



Source: Leu and Hanser 2011
Human-footprint-intensity classes are low (Class 1 to 3), intermediate (Class 4 to 6), and high (Class 7 to 10).

WILDLAND FIRE MANAGEMENT AND ECOLOGY

Fire occurrence in the planning area is presented in several subsections detailing fire history, current fire policy, wildland fire suppression, fire regimes, and current fire management.

FIRE HISTORY

Between 1991 and 2011, the BLM responded to 2,012 fires that burned 908,053 acres across the planning area. The BLM responds to wildfires on USFS-, USFWS-, and BLM-administered lands and assists on Tribal, state, and local agency wildfire suppression actions within the Eastern Montana Fire Zone. The Eastern Montana Fire Zone exhibits a very active fire season, with an average annual fire occurrence of 96 fires. Wildfire size and duration are affected by terrain, weather conditions, and fuel type. Although similar fuel type and terrain occur throughout the planning area, higher frequencies of fires occur in areas with timber and higher elevation. The major cause of fires is lightning and multiple fire start days are common during the months of July through September. Generally, the season starts in June and continues through September with the majority of the fires occurring during July and August (Table 3-24 and Map 58).

Miller Creek prescribed fire in southeastern Montana

CURRENT FIRE POLICY

Until the 1960s, federal fire policy emphasized control of all wildfires by 10:00 a.m. the following day. Prompted by passage of the Wilderness Act of 1964 (16 U.S.C. 1131 et seq.), fire managers began to consider the natural role of fire in the environment. This changed the strategy from fire control to one of fire management. Options available under this new fire management strategy allowed for fire by prescription and a range of suppression alternatives to achieve fire management objectives. The 2009 *Guidance for the Implementation of Federal Wildland Fire Management Policy* (USFS, BLM, BIA, USFWS, and NPS 2009) provides revised direction for consistent implementation of the *Review and Update of the 1995 Federal Wildland Fire Management Policy* (USDI et al. 2001). The current guidance allows fire managers to use various wildland fire management responses for all wildland fires. These responses vary from aggressive initial attack with the intent of minimizing the number of acres burned to monitoring fires in an effort to reduce suppression costs, provide resource benefits, and reduce firefighter exposure to the hazards of fire suppression.

The Big Dry and Powder River RMPs, the *Montana State Office Fire/Fuels Management Plan Environmental Assessment/Plan Amendment for Montana and the Dakotas*, and the MCFO *Fire Management Plan* currently guide wildland fire management in the planning area (BLM 1985c, 1996, 2003k, and 2004f).

The *Montana State Office Fire/Fuels Management Plan Environmental Assessment/Plan Amendment for Montana and the Dakotas* (BLM 2003k) amended the Big Dry and Powder River RMPs to update direction for fire and fuels management. These amendments provided:

- consistent fire management direction by assigning fire management categories and broad levels of treatment;
- general guidance for fire management needed to protect other resource values; and
- revisions to RMP decisions that limited the BLM's ability to conduct safe and efficient mechanical hazardous fuels treatments.

**TABLE 3-24.
FIRE HISTORY BY FIRE SIZE CLASS IN THE EASTERN MONTANA ZONE (1991 TO 2011)**

Fire Management Unit	Fire Class							Total Number of Fires	Total Acres
	A	B	C	D	E	F	G		
Cedar Breaks	1	3	2	0	0	0	0	**6**	**141**
Mixed Grass Prairie Sagebrush	32	197	165	47	57	27	11	**536**	**359,017**
Rural Interface	16	25	5	1	3	1	0	**51**	**2,858**
Vicinity of Custer National Forest	72	216	54	11	8	12	6	**379**	**179,543**
Knowlton-Locate	1	5	1	2	0	0	0	**9**	**1,291**
Missouri-Musselshell River Breaks	16	57	35	10	5	4	2	**129**	**148,398**
Ashland Ranger District	191	466	64	8	10	5	8	**752**	**215,873**
Sioux Ranger District	45	90	13	2	0	0	0	**150**	**933**
Total	**374**	**1,059**	**339**	**81**	**83**	**49**	**27**	**2,012**	**908,054**

Fire Class Sizes: A (less than 0.2 acres), B (0.3 to 9 acres), C (10 to 99 acres), D (100 to 299 acres), E (300 to 999 acres), F (1,000 to 4,999 acres), and G (more than 5,000 acres).

WILDLAND FIRE SUPPRESSION

Previous land use planning handbook guidance required RMPs to categorize lands in fire management zones into fire management categories (A through D). Under current management, the MCFO lists seven fire management zones, categorized as B or C. Current fire management planning and land use planning guidance does not require fire management categories and recommends the use of fire management units definable by similar vegetation type and condition, predominant historical fire regime groups, and management constraints, objectives, and strategies. Fire management units are a dynamic boundary designed to be redrawn as resource uses within those areas change and resource management considerations change. For each fire management unit, management recommendations are developed for the following fire management activities: wildland fire suppression, management of wildland fire to meet multiple objectives, prescribed fire and non-fire fuel treatment, emergency stabilization, rehabilitation, and community assistance or protection.

General management considerations are:

- to use sound scientific resource management principles to restore or sustain ecosystem health (balanced with other socioeconomic goals including public health and safety) and air quality;
- to identify and provide wildland fire response on all wildland fires consistent with resource objectives, standards, and guidelines;
- to use prescribed fire, mechanical, chemical, and biological treatments to meet management goals and objectives;
- to work collaboratively with communities at risk to develop plans for risk reduction; and
- to work collaboratively with federal, state, and local partners to develop cross-boundary management strategies and prioritize cross-agency fire management actions.

Following direction from the Healthy Forests Restoration Act in 2003 (16 U.S.C. 6501 et seq.), the MCFO is partners in community wildfire protection plans developed pursuant to enactment of this law. This legislation includes statutory incentives for BLM to consider the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. These plans are dynamic and regularly updated by each county. The BLM works with counties to identify high-risk areas and work cooperatively to mitigate fire risk to identified communities. All but three counties in the planning area have completed community wildlife protection plans. Currently, all communities within the planning area are rated moderate to high for risk of property loss from wildland fire.

Fire management includes management responses that range from a full suppression response to minimal impact tactics and utilization of wildfire to achieve ecological benefits. The type of management response or the combination of various methods is dependent on the goals and objectives within the fire management unit. Advancement in suppression equipment technology has improved the effectiveness and efficiency of many types of fire suppression apparatus and associated suppression products available to fire managers. In addition to use of water, foams, gels and retardants are currently available to fire managers within the federal agencies. Method of application of these products also varies from standard engine apparatus to use of Large Air tanker aircraft. Aerial delivery of fire retardant has been in use for over 60 years in the federal fire suppression agencies on public lands. More recently, aerial delivery of foam and gel has been utilized in areas of the county. Aerial delivery of suppression chemicals has proven to be a safe efficient and effective in controlling wildfires that otherwise would be uncontrollable by ground methods. Through research and development, changes in chemical components of fire retardant have resulted in products available to the federal fire agencies that are safer to the environment and more effective in wildfire suppression. In 2011, the federal fire agencies aerially delivered 23,495,040 gallons of fire retardant on wildfires throughout the United States. Over the past 12 years of data collected, there was a total of 1,421,405 gallons of retardant delivered on wildfires throughout the planning area. In a recent (the ROD was signed in 2011) EIS completed by the USFS, in which the BLM was a cooperating agency, the analysis recognized four main issues related to fire retardant use on USFS lands and its effects. Health and human safety, water quality, impacts on threatened and endangered species, and Impacts on cultural resources were the four main issues for which the EIS analysis focused. Within the planning area, effects from suppression foams, gels, and retardant to these same four issues are analyzed.

FIRE REGIMES

According to coarse-scale estimates, fire regimes have been altered on BLM-administered lands; the result is evident in the increasing changes of fire size, intensity, and landscape pattern. Fire regimes on BLM-administered lands are characterized by three potential natural vegetation groups (PNVGs) described by the Landscape Fire and Resource Management Planning Tools Project (LANDFIRE) (Map 59), a joint USFS and USDI program, as vegetation communities existing under the natural range of variability in biophysical environments and ecological processes (2007):

- Plains Grassland, 1,630,784 acres;
- Shrubland, 837,855 acres; and
- Tree, 559,400 acres.

This biophysical classification was based originally on A.W. Kuchler's 1964 *Potential Natural Vegetation of the Conterminous United States* (American Geographic Society Special Publication No. 36) and modified during the *Coarse-Scale Fire Regime Condition Class Assessment* (Schmidt, Menakis, Hardy, Hann, and Bunnell 2002). PNVGs are broad vegetation classes useful for planning purposes. Fire regime and condition classes (FR/CC) (Hann et al. 2008) reflect the degree of departure from modeled reference conditions. FR/CC assessments measure departure in two main components of ecosystems: fire regime (fire frequency and severity) and associated vegetation. Implementation of all fire management activities are based on project-specific surveys.

The Plains Grassland PNVG is found scattered throughout the decision planning area, occurring on rolling uplands and flats where naturally frequent fires excluded shrubs and maintained grass dominance. The historical fire return interval in this PNVG was about 8 to 12 years. Fires are more frequent in productive closed grass types, and flashy light fuel types cause moderate to high rates of spread in these areas. However, development, grazing, and elimination of fire as an ecological process have resulted in a moderate departure from this fire regime (USFS and USDI 2007). Several communities in the planning area within or near this PNVG are at moderate risk from wildfire.

The Shrubland PNVG is found throughout the planning area. The historical fire return interval in this PNVG has a mixed fire regime with a 15- to 20-year frequency. Removal of fire as an ecological process, conifer encroachment, development, and grazing have resulted in a moderate departure from this fire regime. Flashy light fuel types in cause moderate to high rates of spread in these areas. Fires starting during times of critical or high fire danger continue when frequent high winds rapidly change small fires into large fires (USFS and USDI 2007). Most communities located within or near this PNVG are at moderate risk from wildfire.

The Ponderosa Pine PNVG is found scattered throughout the planning area, occurring mostly within the Missouri Breaks in Garfield County, areas south of the Yellowstone River, Ekalaka Hills-Chalk Buttes in Carter County, Cedar Creek Anticline, and Terry Badlands. The historical fire return interval in this PNVG is approximately 25 years, but uncharacteristic succession and numerous missed fire-return intervals have caused a high departure from this fire regime (USFS and USDI 2007). In the Missouri Breaks, large fires exceeding 1,000 acres have occurred every 3 years on an average. Wind, low fuel moistures, and ladder fuels increase the likelihood of extreme fire behavior. Forest stand densities are high, and these areas are at risk for large stand-replacing fires. There are several communities at high risk from wildfire within or near this PNVG.

Climatic Change and Fire Regime and Wildfire

Evidence of wildfire can be traced through the review of fire scars across all landscapes in the Northern Rockies. Research conducted in forested sub-regions in the Northern Rockies suggests climatic change has had an effect on fire regimes. Historical wildfire observations exhibit an abrupt transition in the mid-1980s from a regime of infrequent large wildfires of short (average of 1 week) duration to one with much more frequent and longer-burning (5 weeks) fires. This transition was marked by a shift toward unusually warm springs, longer summer dry seasons, drier vegetation (which provoked more and longer-burning large wildfires), and longer fire seasons (Westerling et al. 2006b).

The Cost of Wildfire Management

The MCFO planning area is an intermix of BLM-administered lands among private, state, and other federal agency jurisdictions. Wildfire occurs on all lands and all jurisdictions and wildfire suppression efforts often involve all jurisdictional agencies. The cost of wildfire goes beyond suppression activities. Suppression costs are dependent on many factors; including, but not limited to, location of the fire, fuel type, weather conditions, duration of the event, the quantity and type of suppression resources used, actions to rehabilitate suppression activity damage to lands and infrastructure, and subsequent emergency stabilization and rehabilitation actions. Other costs or “losses” include timber and forage values, wildlife habitat and populations (including endangered species and their critically protected habitat), air and water quality, recreational opportunities, local economies, and other resources and amenities important to all citizens. These costs are difficult to calculate and are often shared among many protecting agencies, therefore not definitive to any given protecting agency.

Nationally, the cost of wildfire management, specifically suppression has dramatically increased. “Suppression costs only represent a small portion of over-all wildfire costs and losses, however, and other direct costs, indirect losses, and postfire costs and losses can total 10 to 50 times (or more) the suppression costs.” (Zybach, Dubrasich, Brenner, and Marker 2009, p. 14). Longer periods of dryness and drought caused by global climate change provides more fuel to burn and results in longer wildfire seasons, which (along with population growth and urban sprawl into the wildland-urban interface) contribute to increased wildfire suppression costs.

CULTURAL RESOURCES

The BLM is responsible for identifying, protecting, managing, and enhancing cultural resources located on public lands or nonfederal lands that may be affected by BLM management actions. Cultural resources include archeological, historic, architectural properties, and traditional lifeway values important to American Indian groups. Sites can vary with regard to their intrinsic value and their significance to scientific study; therefore, management practices employed are commensurate with their designation.

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 in which prehistoric or historic activity measurably altered the earth or in which 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 American Indians or other groups consider essential for the preservation of traditional culture.

Prehistoric and historic cultural resources are a nonrenewable resource. Significant cultural resources have many values, including use in gathering scientific information on human culture and history, interpretive and educational values, values associated with important people and events of significance in history, and aesthetic value (such as a prehistoric rock art panel or an historic landscape). Cultural resource sites may also have traditional cultural values that are important to American Indian Tribes for maintaining their culture and cultural identity.

According to BLM Manual 8110, the primary objectives of the cultural resources program are to manage BLM-administered cultural resources through a system of identification, evaluation, interpretation, utilization, and reduction of conflict between cultural resources and other resources and resource uses. Cultural resource management objectives would include developing site or area-specific activity plans to identify cultural resource use and protection objectives and outline procedures for evaluating accomplishments.

To focus management on the variety of identified cultural resources, sites would be assigned to cultural resource use categories as defined in the BLM Manual 8110 and the *Cultural Resources Appendix*. Categorizing cultural resources according to their potential uses is the culmination of the identification process and the bridge to protection and utilization decisions. Use categories establish what needs to be protected, and when or how use should be authorized. All cultural resources have uses, but not all should be used in the same way. Classes of cultural resources can be allocated to the various recognized use categories even before they are individually identified. The advantage in doing this is that it allows field office managers to know in advance how to respond to conflicts that arise between specific cultural resources and other land uses. Relative to the 2012 national *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*, categorizing resources to uses provides a mechanism for the field office manager and the state historic preservation officer to confer and concur on how to handle most routine cases of conflict in advance, which enables the field office manager to put decisions into effect in the most appropriate and most timely manner.

The BLM would comply with Sections 106 and 110 of the National Historic Preservation Act (NHPA) for all federal undertakings, which include avoiding impacts to significant cultural resources through project redesign, mitigation of adverse impacts, and investigation and prosecution of unauthorized use or destruction of significant cultural properties. In emergency situations, such as a disaster or emergency declared by the President, a tribal government, or the Governor or in response to other immediate threats to life or property (such as a wildfire or flood), Section 106 would be waived, in accordance with 36 CFR Part 800.12, and the BLM would notify the state historic preservation office within 7 days of emergency procedures. Impacts to cultural sites eligible for the National Register of Historic Places (NRHP) resulting from federal undertakings would be avoided by project abandonment, project redesign, or, as a last resort, mitigation of adverse impacts through data recovery or other alternative means.

HISTORY OF CULTURAL RESOURCE INVESTIGATIONS IN THE PLANNING AREA

Site identification and recording in the planning area dates to the mid-20th century, when the Montana Archeological Survey and the Works Project Administration conducted excavations on several sites in southeastern Montana in the 1930s (including the Hagen National Historic Landmark [NHL] [24DW0002]). 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 NHPA and provisions of 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 administered by those agencies.

The BLM is responsible for ensuring that lands leased for development (such as oil, gas, or coal development) are examined prior to allowing any development actions to occur to determine the presence of cultural resources and to specify mitigation measures. For oil and gas development, the BLM employs a phased approach to site identification and completes site identification surveys at the application for permit to drill (APD) stage. Guidance for application of this requirement for oil and gas development can be found in the notice to lease, MSO-1-85, Washington Office (WO) IM 2005-03, and Montana IMs 2003-035 and 2006-040 (BLM 1985b).

Cultural resource awareness programs, including educational programs, presentations, and interpretive displays, would be designed to enhance the public appreciation of cultural resource values, and the BLM would make significant cultural sites available for scientific study. The agency would conduct Class I, II, or III cultural inventories for lands that included surface disturbances as part of the action. Class III inventories are usually required before surface-disturbing actions are authorized by BLM (and before land disposal actions).

The BLM would accommodate access to public lands by American Indians to enable tribes to maintain traditional values intrinsic to their cultural identities in accordance with Executive Order 13007 (May 29, 1996). The BLM would also conduct consultations with American Indian Tribes as sovereign nations in a government-to-government relationship. Prior to site-specific project approval, BLM would consult with affected tribes to identify cultural values or religious beliefs that might be affected by BLM proposed actions.

RESOURCES IN THE PLANNING AREA

In general, cultural resources are identified through field inventories conducted by qualified professionals in order to comply with Section 106 of NHPA. Informant information and historical records are also used to identify archeological, historical, and traditional lifeway values and traditional cultural properties (TCPs). Three types of inventories (Class I, Class II, and Class III) are conducted to identify and assess these values on BLM-administered lands and are defined below.

- Class I, existing information inventory: a Class I inventory is most useful for gaining a comprehensive view of all the known archeological, historic, cultural, and traditional places within a large area, such as the area to be covered by a land-use plan or an EIS. A Class I inventory is a professionally prepared study that includes a compilation and analysis of all reasonably available cultural resource data and literature and a management-focused, interpretive, narrative overview and synthesis of the data. The overview also defines regional research questions and treatment options. Existing cultural resource data are obtained from published and unpublished documents, BLM cultural resource inventory records, institutional site files, state and national registers, interviews, and other information sources. Class I inventories, which should have prehistoric, historic, and ethnological elements, are in large part chronicles of past land uses, and as such they should be relevant to current land use decisions. General information about sacred sites and other places of traditional cultural or religious importance to American Indians or other cultural groups (including TCPs as discussed in the 1998 National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*) should be included as much as possible in the inventory. Class I inventories are periodically updated, in both the compilation and the synthesis, to incorporate new data from Class II and Class III inventories, histories, oral testimony, and other sources. They can be used to develop regional research designs for resource evaluation. Maintaining current Class I inventories in GIS-compatible format is of critical importance for making cultural resources information readily available for research, planning, management, and compliance activities.
- Class II, probabilistic field survey: a Class II survey is most useful for improving cultural resource information in a large area, such as for planning or EIS purposes, in which insufficient systematic identification work has been done in the past. A Class II probabilistic field survey is a statistically based sample survey designed to aid in characterizing the probable density, diversity, and distribution of cultural properties in an area, to develop and test predictive models, and to answer certain kinds of

research questions. Within individual sample units, survey aims, methods, and intensity are the same as those applied in a Class III survey. Class II surveys may be conducted in several phases using different sample designs to improve statistical reliability.

- Class II surveys may be appropriate when comparing alternative locations for proposed undertakings. Class II surveys are generally not appropriate for determining specific effects of a proposed land use, except when the sample distribution and sample rate have proven to be sufficient to demonstrate that the specific environmental situations in the area sampled did not support human occupation or use to a degree that would make further field survey information useful or meaningful. Class II surveys may be appropriate when existing information about the project area or similar environments indicates that a properly designed sample survey would adequately address the relevant research questions about past human use of the area. Class II surveys are generally not appropriate where designing a sample and executing a discontinuous survey may prove more demanding and time-consuming than a continuous Class III survey.
- Class II surveys may be appropriate for testing hypotheses about presence or absence of significant prehistoric and historic archeological and architectural properties, such as:
  - when the regional inventory suggests a significant correlation between certain environmental variables and particular significant property types, which can be tested through sampling the study area;
  - when comparative effects or cumulative effects assessments are needed for environmental documentation;
  - when Class I data are found to be biased or otherwise insufficient to allow for reasoned judgments during general land use planning or activity planning; and
  - when generating statistical data needed for developing and testing predictive models.

- Class III, intensive field survey: an intensive survey is most useful when it is necessary to know precisely what historic properties exist in a given area or when information sufficient for later evaluation and treatment decisions is needed on individual historic properties. Intensive survey describes the distribution of properties in an area; determines the number, location, and condition of properties; determines the types of properties actually present within the area; permits classification of individual properties; and records the physical extent of specific properties.

Number of Cultural Resource Sites Recorded in the Planning Area

Cultural resource investigations in the planning area have recorded approximately 9,934 prehistoric and historic cultural resources. A recent Class I overview of cultural resources was prepared for the planning area; as of May 1, 2005, the planning area contained 7,065 prehistoric sites and 2,869 historic sites (Aaberg, Hanna, Crofutt, Green, and Vischer 2006). Historic and prehistoric sites occur in all counties within the planning area and represent a wide variety of site types and chronological periods; together, these resources document an almost continuous record of human occupation for the past 14,000 years.

Based on studies conducted in the planning area (Aaberg et al. 2006), there is an estimated average density estimate of one cultural site for every 100 acres of land (BLM-administered and private surface) .Of these, approximately 10 to 15 percent of cultural resources are found eligible for the NRHP. Furthermore, there is an average of one research excavation every 5 years, which disturbs 1 to 5 acres. About 3.6 percent of the surface area in the planning area has undergone surface surveys of varying intensity. Of the 2,135 prehistoric and historic sites located on BLM-administered surface within the planning area, distribution and site density estimates are approximately 1 site per 195 acres (5.1 sites per 1,000 acres).

Of the total cultural properties in the project area, 2,135 (28.5 percent) occur either entirely or partially on BLM-administered land (Aaberg et al. 2006). The BLM site total includes 1,839 (86.1 percent) prehistoric sites and 296 (13.9 percent) historic sites; subsequently, 26 percent of all project area prehistoric sites and 10.3 percent of all project area historic sites in the planning area are either entirely or partially administered by the BLM.

Distribution of the 4,835 prehistoric and historic sites fully or partially located on lands of mixed ownership and administration is 1 site per 45.5 acres (22 sites per 1,000 acres) or 14.1 sites per square mile for the 220,187 acres of surveys conducted in this category. These sites include 2,756 prehistoric sites at 1 site per 79.9 acres (12.5 sites per 1,000 acres) or 8 sites per square mile. Also included are 2,079 historic properties at 1 site per 105.9 acres (9.4 sites per 1,000 acres) or 6 sites per square mile.

Within the planning area, of the 11,863 cultural and paleontological sites, only 66 have been formally nominated to the NRHP. Those sites listed are almost exclusively historic, with only two prehistoric sites nominated.

Although state database and agency records are sometimes conflicting, it appears that about 5 percent of historic sites have been recommended (consensus varies) as eligible for listing in the NRHP and about 12 percent have been recommended and accepted as ineligible by the state historic preservation office. Significance or NRHP status for about 81 percent of historic sites is either unresolved or not presented on the state database. About 4 percent of prehistoric sites have been recommended as eligible (consensus varies) for listing in the NRHP while 6 percent have been recommended and accepted as ineligible. Significance or NRHP status of about 90 percent of prehistoric sites has either not been resolved or is not presented on the state database.

The area of cultural resource surveying that occurred in the planning area over the past 35 years totals about 923,849 acres (Aaberg et al. 2006). Of that total, about 45 percent occurred on BLM-administered surfaces, 13 percent on USFS estate, 10 percent on American Indian reservations, 4 percent on Montana Department of Transportation land, and 4 percent on MDNRC land. Private lands and a combination of other federal, state, and agency lands account for the remaining 24 percent of the total area surveyed.

PREHISTORIC AND PROTOHISTORIC PERIOD

A generalized prehistory of eastern Montana can be categorized in a chronological framework in which periods are distinguished based on differences in material culture traits or artifacts and subsistence patterns. For information on the Paleo-Indian (ca. 12,500 before present [BP] to 7800 BP), Archaic (ca. 7800 BP to 1500 BP), Prehistoric (ca. 1500 BP to 200 BP), Protohistoric (ca. 250 BP to 100 BP), and Historic Periods, refer to the Class I Overview discussion and a more in-depth discussion of the planning area's cultural chronology refer to the Class I Overview discussion (see Number of Cultural Resource Sites Recorded in the Planning Area).

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. Protohistoric refers to the variable transition period from prehistoric to historic, and historic is the period 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 approximately 12,000 to 15,000 years ago, or perhaps much earlier, as posited in recent data (Aaberg et al. 2006). The Protohistoric Period in southeastern Montana is generally defined as the period in which the horse and European trade goods reached native cultures. Introduction of the horse in the Northern Plains area probably occurred sometime between A.D. 1700 and A.D. 1750 but appears to have occurred earlier in localities just south of Montana and later in more northern localities. The earliest European to venture into the planning area was likely that of the Frenchman Sieur de la Verendrye in 1742, followed by Francois Larocque of the Canadian-owned North West Company, passing through the area in 1805. However, substantial contact and white settlement of the area did not occur until after Lewis and Clark visited the area in 1805 and 1806 (Aaberg et al. 2006), which ushered in the Historic Period, and not until fur-trading posts were established on the Yellowstone and upper Missouri rivers in the early 1800s, which 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 circles and rock alignments, rock art, rock shelters, ceramic sites, quarries and secondary lithic procurement sites, structures, and bison kill and butchering sites. Recorded historic cultural resources in the planning area include trails; freight wagon, stagecoach, and military trails; Indian-War-period battle sites; early ranches and farms; stockherding camps; irrigation systems; mines; early oil fields and associated camps; railroads, bridges; and urban buildings.

American Indian Site Types in the Planning Area

American Indian prehistoric sites listed in the planning area include a number of sites or characteristics. Generalized or composite site types that are the most commonly occurring types in the planning area include those described below.

- 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 the reduction of stone material into useable tools.
- Cairns: piles of stones deposited by prehistoric people for a variety of purposes (including stockpiling of lithic source materials, marking burials, or during other ceremonial events) as hide preparation platforms, locational markers for trails, or other resources.
- Stone circles: rings of rocks that might represent former locations of tipis or other structures, prehistoric ceremonial activities, or habitation sites consisting of lodge sites for prehistoric structures (could include features such as stone rings and cairns).
- Campsites: locations that contain evidence of at least short-term occupation by prehistoric people and which may include lithics, evidence of habitation structures (stone rings), evidence of food preparation (fire-cracked rocks), and ceramics.
- Burials: physical human remains, deliberately interred or not.
- Kill sites or butchering or 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.
- 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.
- Ceremonial: sites that include large stone circle presumed to be used for ceremonial purposes.
- Stone alignments and effigies: usually considered to be associated with ceremonial or spiritual activities, but some alignments could have been associated with big game hunting or functioned as locational landmarks.

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 can be grouped into 11 thematic or site-type groups, as described below.

- 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 or ranches: residences and outbuildings or fields and facilities associated with operation of a farm or ranch or, occasionally, 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, battlefields, and transportation or communications features that can be related directly to military activities.
- Mineral exploration and extraction: oil, gas, coal, or other mining locations and associated features.
- Stockherding: typically camps that are not principal ranches or farm headquarters and cairns that cannot be attributed to some prehistoric or aboriginal activity.
- Transportation or communications sites: trails, expansion-era stagecoach and freight-wagon roads, military roads, railroads, bridges, telephone and telegraph lines, and, in some cases, power lines.
- Urban buildings: historic buildings in cities, towns, or villages not directly associated with other categories.

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

There are a number of areas designated NHLs, archeological landscape districts, or archeological districts of particular interest to this RMP, including the:

- Spring Creek Archeological District (24BH3584) (Big Horn County),
- Battle of the Rosebud NHL (24BH2461) (Big Horn County),
- Wolf Mountains Battlefield NHL (24RB0787) (Rosebud County),
- Lee Community Historic District (24RB2053) (Rosebud County),
- Castle Rock Community Historic District (24RB2090 and 24TE0119) (Rosebud County),
- Deer Medicine Rocks NHL (24RB0401) (Rosebud County, and
- Fort Union Trading Post NHL (24RV0050) (Roosevelt County).

Sites of Specific Concern to American Indians

To date, the planning area does not contain any known TCPs, as defined by the 1998 National Park Service Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, on BLM-administered surface, nor does it contain any identified specific traditional gathering areas. However, the lack of these defined features does not mean that American Indian 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 Battle Sites

Most American Indian Tribes believe that burials and burial sites are sacred and should not be disturbed, and there are many battle sites in the planning area considered important to tribes in the region.

Ceremonial Sites and Petroglyphs

The medicine wheel site type, which is considered sacred, potentially represent ceremonial events (such as sun dances) or calendars associated with seasonal variation in the region. They are also considered sacred because they may relate to vision quests and other religious activities. These site types are significant and need preservation because they may be important to tribes in the region.

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.

Sites of Specific Concern within the Planning Area

Some sites and site types of special concern and that need special management have been designated ACECs in past planning efforts. Other sites and site types are sensitive to their setting and require special consideration and management to protect their setting and surrounding landscapes, such as sites of interest to American

Indians. Other sites or site types do not need any special setting protections, such as the Lewis and Clark Bridge over the Missouri River south of Wolf Point, Montana, on State Highway 13.

A number of other sites have moderately sensitive settings and require some management protections from changes to their immediate surroundings. Most of these sites are bison kill or processing sites and include the Seline (24DW0250), Jordan Bison Kill (24GF0271), Yonkee (24PR0005), and Mill Iron (24CT0030) sites. Each of these sites have either been designated ACECs or are proposed ACECs in this RMP. Also included in this category is the Hoe ACEC (24PE0263) site, a site containing evidence of past horticultural practices and the Big Sheep Mountain (24PE0210) ACEC, which is a Late Middle Period-Pelican Lake phase habitation site with buried hearths.

The planning area also contains many sites with very sensitive settings that require a greater degree of protection from management actions with the potential to alter the surrounding setting. Included in this category are the site types and sites described below.

- Indian-War-era sites and battle sites, which include the areas described below.

    - Ash Creek Battlefield (24PE0629): this area was the site of an 1876 Sioux War battle between Sitting Bull and the United States Army (Lieutenant Baldwin under Colonel Miles) along Ash Creek, a tributary of the Redwater River south of Brockway, Montana.
    - Rosebud Battlefield NHL (24BH2461): this site, which is designated an NHL, represents one of the major engagements of the Sioux War of 1876. The battle, between the Sioux and Cheyenne and the United States Army (General Crook), occurred along Rosebud Creek north of Decker, Montana.
    - Mouth of Redwater fight site (no site number): this was the site of a brief battle along the Missouri River at the mouth of Redwater River between the United States Army (Lieutenant Baldwin under Colonel Miles) and Sitting Bull and his followers.
    - Spring Creek fight site (no site number): this area was the site of a series of skirmishes in which bands of Sioux warriors attacked a supply wagon train bound for the Tongue River Cantonment between Glendive and Fallon, Montana, during the 1876 Sioux War.
    - O'Fallon Creek Battle (24PE0734): site of an 1872 Indian War battle between Sitting Bull and the Lakota Sioux and the United States Army (under Colonel Stanley) while the latter members were guarding railroad surveyors near the mouth of O'Fallon Creek.
    - Reynolds Battlefield ACEC (24PR0089): portions of this battlefield are already designated an ACEC and the remaining area is proposed for ACEC designation. This is the site of the opening battle of the Sioux War of 1876 between the United States Army (Colonel Reynolds under General Crook's command) and the Cheyenne occurred along the Powder River.
    - Battle Butte ACEC (24RB0787): portions of this battlefield, which includes the Wolf Mountain NHL, are already designated an ACEC and the remaining area is proposed for ACEC designation. This site of an 1877 Sioux War battle between Colonel Miles and Crazy Horse and the Oglala Lakota is situated along the Tongue River.
    - Powder River Depot ACEC (24PE0231): this area has been designated an ACEC. This site, which is located on the Yellowstone River near the mouth of the Powder River, was a major campsite and supply depot for the United States Army under General Terry and Colonel Custer during the Sioux War of 1876.
    - Cedar Creek Battlefield (24PE0261): this site, which is proposed for ACEC designation, was the site of a battle between Sitting Bull and the Lakota Sioux and the United States Army (under Colonel Miles) in the hills along the upper reaches of Cedar Creek north of Terry, Montana.

- Historic trails and Fur-Trade-era sites, which include the Lewis and Clark Trail and Fort Union NHL.

    - Lewis and Clark Trail: this area is a corridor that encompasses portions of the Missouri and Yellowstone Rivers and commemorates the Lewis and Clark expedition from 1805 to 1806.
    - Fort Union NHL (24RV0050): this site represents one of the major Fur Trade era trading

posts on the upper Missouri River. Established in 1828 by John Jacob Astor's American Fur Company, it became the headquarters for trading beaver pelts and buffalo hides with tribes of the upper Missouri and Yellowstone River regions.

- Prehistoric village sites, which include the Hagen site NHL (24DW0002), which is a village occupation site on the banks of the Yellowstone River once occupied by Middle Missouri horticulturists, such as the Mandan.
- Sites and landscapes of American Indian interest include the areas described below.
  - Long Medicine Wheel (24MC0148): this site, which includes a large stone ceremonial circle, is proposed for ACEC designation and is a very rare site type of religious significance to American Indian Tribes.
  - Deer Medicine Rocks (24RB0401): a petroglyph site of great religious significance to American Indian Tribes, particularly the Sioux, in which Sitting Bull's vision of soldiers falling into camp is depicted. This site is used for traditional cultural purposes.
  - Belle Creek Medicine Wheel (24PR0881): this site, which consists of a large stone circle with spokes, is another example of a very rare site type (like Long Medicine Wheel) of religious significance to American Indian Tribes.
  - Chalk Buttes Medicine Wheel (24CT0309): this site, which is a large stone circle with interior divisions, is within the USFS-administered unit of the Chalk Buttes and yet another example of a very rare site type of religious significance to American Indian Tribes. This site is used for traditional cultural purposes.
  - Chalk Buttes: is a site that includes an upland mountainous chain of buttes with religious significance to American Indian Tribes. Sitting Bull and Crazy Horse wintered in this area prior to the Sioux War of 1876, and the area is still in use for traditional cultural purposes by American Indian Tribes. This area has been determined a TCP and is recommended for eligibility to the NRHP, and the entire area is used for traditional cultural purposes.
  - Medicine Rocks State Park: this area has also been determined a TCP and is recommended for eligibility to the NRHP. In addition, the entire area is used for traditional cultural purposes.
  - Tongue River Valley Cultural Landscape: this area extends from the Tongue River Dam in the south to Ashland, Montana, in the north and is both a Cultural Rural Historic Landscape and an Ethnographic Landscape for the Cheyenne.

Current Resource Management and the 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, NHPA of 1966, NEPA of 1969, and the Federal Land Policy and Management Act (FLPMA) of 1976, as amended, and Executive Order 11593 (May 13, 1971). BLM manuals 8100, 8110, 8120, and 8130 outline BLM policy and cultural resource program guidance.

In 1997, the BLM developed an agreement addressing means of complying with NHPA, expressed in the updated 2012 national *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*. Pursuant to this agreement, the BLM Montana State Office developed a specific process by which NHPA compliance is accomplished, which is detailed in the 1998 *State Protocol Agreement between the Montana State Director, Bureau of Land Management and the Montana State Historic Preservation Office regarding the manner in which the BLM will meet its responsibilities under the National Historic Preservation Act as provided for in the National Programmatic Agreement.* Apart from certain considerations derived from specific cultural resource statutes, management of cultural resources on public lands is primarily based on FLPMA and fully subject to the same multiple use principles and planning and decision-making processes followed in managing other public land resources.

BLM Manual 8130, *Planning for Uses of Cultural Resources* (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.

CULTURAL RESOURCES, CONDITION AND TREND

The diversity of terrain, geomorphology, access and visibility, and past and current land use patterns cause considerable variation in the condition and trend of cultural resources in the planning area. Recorded sites are manifest by exposed artifacts, features, or structures; therefore, they are easily disturbed by elements such as wind and water erosion, animal and human intrusion, natural deterioration and decay, and development and maintenance activities.

Based on limited site monitoring, site-form documentation, and other information, site conditions in the planning area are trending downward. Active vandalism or collecting (unauthorized digging and pothunting) has been observed in limited instances, but is not currently endemic. Consequences of development and maintenance activities (e.g., erosion, grazing, mining, and recreation) are affecting a limited number of site locations, but the most pressing concern is the natural deterioration and decay of standing structures at historic mining and homesteading sites and prehistoric wickiups. Collectively, these agents adversely affected many known cultural resources and continue to do so today.

Within the planning area, the demand for cultural resources is considered moderate; this determination is based on known research interests of area scholars and other professionals, interest expressed by members of the American Indian and local communities, documented site conditions, and site visitation. Many interpretive opportunities are also present to provide educational and recreational benefits.

Use Categories

BLM planning and manual guidance stresses the importance of meeting specified goals through the allocation of all cultural properties in the planning area (whether properties are already recorded or projected to occur) into defined use categories, based on their nature and relative preservation value. The identified use categories include:

- Scientific use sites, which are preserved until research potential is realized;
- Conservation for future use sites, which are preserved until conditions for use are met;
- Traditional use sites, which encompass long-term preservation of sites for American Indian use;
- Public use sites, which encompass long-term preservation of sites and on-site interpretation;
- Experimental use sites, which are protected until used; and
- Discharged from management sites, which are removed from protective measures.

BLM Manual 8130 provides a detailed description of individual use categories. The majority of sites will fall in the scientific use and discharged from management categories, while the other categories are likely to be associated with particular settings that can be geographically delineated. The conservation for future use, traditional use, public use, and experimental use categories will require the most attention in order to balance their proactive uses with other land and resource uses. A detailed description of individual use categories is presented in the *Cultural Resources Appendix*.

In order to allocate the numerous known sites and those sites projected to occur (sites yet to be found or recorded) into the identified use categories, criteria must be established that employ a combination of easily recognizable site-type and site-attribute information that can, for example, differentiate between small, short duration, limited-activity sites and large, complex, multiple-activity sites. For prehistoric resources, the criteria are weighted to emphasize the information potential since the determination of significance for such sites are generally related to their scientific value. For historic resources, the criteria are more reflective of site condition and integrity characteristics, which play a greater role in the evaluation of historic properties.

It is also important to recognize that it is possible for sites to be placed into more than one use category; a prehistoric site with little or no scientific value could be placed in a discharged from management category, but could also be appropriate in the experimental use category. Similarly, an historic site could be placed in the public use category, but require stabilization and preservation efforts and therefore warrant placement into the conserve for future use category as well.

The term designated area or site used in the Chapter 2 table, *2-1 Comparison of Alternatives*, refers to sites or areas that are currently designated or that meet the criteria for allocation for designation for one of the use categories; scientific use, conservation use, traditional use (socio-cultural use), public use, and experimental use. It also includes the boundaries of sites or districts eligible for, or included on, the NRHP as well as boundaries of TCPs or designated sites or areas, or sites or areas that meet the criteria for allocation for designation for traditional use (for cultural properties determined to be of particular importance to American Indian groups).

TCPs include cultural properties determined to be of particular importance to American Indian groups (in accordance with National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*; Parker and King 1998), or designated for traditional use. Such properties include, (but are not limited to) burial location, pictograph or petroglyph sites, vision quest locations, plant-gathering locations, and areas used for religious purposes or considered sacred.

BLM Manual 8110, *Identifying and Evaluating 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 shall be reevaluated and revised, as needed, when circumstances change or new data become available” (8110.41A–B).

The planning area contains outstanding prehistoric and historic cultural resources. Within the planning area, of the 9,934 cultural sites, only 66 have been formally nominated to the NRHP. Of those sites listed, almost all are exclusively historic with only two prehistoric sites listed (the Hagen Site [24DW0002] in Dawson County and the Tipi Hills Site [24SH1008] in Sheridan County). Notable among these, the Hagen site, has been designated an NHL. Other notable prehistoric sites that have been determined eligible for listing in the NRHP that require additional or special management attention include the Long Medicine Wheel (a proposed ACEC [24MC0148]), Belle Creek (24PR0881), and Chalk Buttes (24CT0309) medicine wheels; the Big Sheep Mountain (24PE0210), Hoe (24PE0263), Jordan Bison Kill (24GF0271), and Seline site (24DW0250) ACECs; and the Yonkee (24PR0005) and Mill Iron (24 CT0030) sites and proposed ACECs.

Most of the remaining 64 historic-era resources that have been formally nominated to the NRHP are within town limits and are of limited interest because none of these are located on BLM-administered surface or include BLM-administered federal minerals. However, other notable historic-era resources designated NHLs include the Sioux-War-era Rosebud (24BH2461) and Wolf Mountain (24RB0787) (Battle Butte ACEC) Battlefields NHLs and the Fur-Trade-era Fort Union NHL (24RV0050). Other historic sites that have been determined eligible for listing in the NRHP that require additional or special management attention include the Sioux-War-era Reynolds (24PR0089) and Cedar Creek Battlefields (24PE0261) (proposed ACECs), Ash Creek Battlefield (24PE0629), Powder River Depot (24PE0231), Deer Medicine Rocks (24RB0401), Mouth of the Redwater (no site number) and Spring Creek (no site number) fight sites, and O’Fallon Creek Battle site (24PE0734) of 1872.

In addition to the cultural resources listed on the NRHP, 421 historic properties have been formally determined to be eligible for nomination to the NRHP. Of the 7,065 prehistoric sites in the planning area, about 4 percent of prehistoric sites have been recommended as eligible (consensus varies) for listing in the NRHP and about 283 prehistoric sites have been formally determined to be eligible for nomination to the NRHP. Of the 2,869 historic sites recorded within the planning area, about 4.8 percent of historic sites have been recommended as eligible for listing in the NRHP and about 138 historic sites have been formally determined to be eligible for nomination to the NRHP.

Of the approximately 9,934 recorded cultural resources in the planning area, only about 707 recorded prehistoric properties (or about 10 percent) and about 534 historic properties (or about 18.6 percent) have been evaluated for eligibility for nomination to the NRHP. These evaluations include sites that have been listed on the NRHP and sites for which the Montana State Historic Preservation Office has concurred with the evaluation. Concurrence by the state historic preservation office on NRHP evaluations is desirable, and while concurrence is not a foregone conclusion, in most cases the state historic preservation office will usually concur with agency determinations of eligibility. Eligibility for nomination to the NRHP is a major threshold for management consideration of sites. Cultural resource properties that have been formally evaluated can be assigned to one or more of the BLM resource use classifications, but of the approximately 8,693 cultural resources that have not been formally evaluated for NRHP, eligibility can only be assigned to use classifications in a general or categorical sense.

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 would not apply to 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. This use category could also apply to historic archeological sites or the archeological components of building complexes or examples of extractive industry. The most significant sites with extractive scientific value might include bison kill sites, sites with buried components, habitation, or earth lodge village sites. Sites in the planning area are already allocated to scientific use (Table 3-25).

Conservation for Future Use

Manual 8110 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" (8110.42B).

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 MCFO 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.

**TABLE 3-25.
CULTURAL SITES CURRENTLY
ALLOCATED TO USE**

Cultural Resource Use Category	Site
Scientific Use	Yonkee 24PR0005 Mill Iron 24CT0030 Taylor-Siegal Site 24DW0011 Soaring Owl Site 24DW0087 Mini Moon Site 24DW0085 Deadman Site 24CR0297 Jordan Bison Kill 24GF0271 Rosebud Battlefield[1] 24BH2461 Battle Butte and Wolf Mountain Site[1] 24RB0787 Reynolds Battlefield[1] 24PR0089

[1]***Record of Decision, Oil and Gas Amendment, Billings-Powder River-South Dakota Resource Management Plans/Environmental Impact Statements***

Rock art sites fit this category, particularly in terms of research potential and singular cultural importance. With few exceptions, rock art sites 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 include unique artifact types, as should ceremonial sites (such as the Long Medicine Wheel site) (24MC0148) and battlefield sites (such as the Reynolds (24PR0089), Wolf Mountain and Battle Butte (24RB0787), and Cedar Creek (24PE0261) Battlefields, Powder River Depot (24PE0231), and Mouth of the Redwater fight site) (no site number). Other sites that would also qualify for allocation to conservation for future use include the Yonkee site (24PR0005), Mill Iron site (24CT0030), Taylor-Siegal Site (24DW0011), Soaring Owl Site (24DW0087), Mini Moon Site (24DW0085), Deadman Site (24CR0297), Big Sheep Mountain site (24PE0210) and ACEC, Hoe site (24PE0263) and ACEC, Jordan Bison Kill site (24GF0271) and ACEC, Seline site (24DW250) and ACEC, and the Yonkee site (24PR0005) and proposed ACEC and Mill Iron site (24CT0030) and proposed ACEC.

Traditional Use

Traditional use of cultural resources is interpreted as the use of the cultural resource by a specific social 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 the National Register Bulletin 38 (Parker and King 1998).

TCPs in Montana are most commonly associated with American Indians. Because the tribes of the area were removed to reservations both inside and outside the planning area in the 1870s and 1880s, 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 American Indian communities. Rock art localities and ceremonial sites throughout the planning area are likely candidates for the traditional use category. Protection and access limitations are recommended for most of these. Sites that would be considered to be eligible for consideration for allocation to traditional use and which are also sensitive with regard to their setting include rock art sites, ceremonial sites (such as the Long Medicine Wheel site [24MC0148] and proposed ACEC), battlefields (such as the Reynolds Battlefield site [24PR0089] and ACEC and proposed ACEC, Wolf Mountain and Battle Butte Battlefield site [24RB0787] and ACEC and proposed ACEC, and Cedar Creek Battlefield site [24PE0261] and proposed ACEC), Mouth of the Redwater and Spring Creek fight sites, and the Tongue River Valley Cultural Landscape.

Public Use

Long-term preservation and on-site interpretation are most appropriate for cultural resources with visually obvious manifestations of the site's historical or archeological importance. Although the type of on-site 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 the use of education to help preserve the site and similar examples.

All BLM-administered lands are managed for public uses and there is no distinct regulatory threshold for managing cultural resources through long-term preservation and on-site interpretation. Considerations for management in this manner are:

- the relative significance of the resource within historical, archeological, or other cultural context or contexts;
- the sensitivity of the cultural resource to loss or degradation as a result of increased public access; and
- 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. On-site interpretation also is not appropriate for most American Indian TCPs, because of the possible degrading effects of public presence on the setting and feeling of these locations.

Sites that have been considered for allocation to public use include the Lewis and Clark Trail, the Powder River Depot site (24PE0231) and ACEC, Reynolds Battlefield site (24PR0089) and ACEC and proposed ACEC, Wolf Mountain and Battle Butte Battlefield site (24RB0787) and ACEC and proposed ACEC, Cedar Creek Battlefield site (24PE0231) and proposed ACEC, Mouth of the Redwater fight site (no site number).

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. In addition, an archeological site in which there has been past excavation or in which 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. No sites, to date, have been proposed or have been considered for allocation to experimental use in the planning area.

Discharged from Management

This use category would apply to any cultural resource the BLM and the Montana State Historic Preservation Office have determined to be ineligible for nomination to the NRHP or sites that have been removed from BLM administration and management (and federal ownership) through land exchange or have been destroyed from some form of management action, such as coal mining. The BLM has a responsibility to continue to manage cultural resources even if they have been found to be ineligible for the NRHP.

The planning area contains approximately 9,934 recorded cultural resources. Of these, some 768 cultural resource sites have been destroyed, determined to be ineligible for nomination to the NRHP, or determined to be non-contributing elements of eligible properties. According to Manual 8110, 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" (8110.42F). Of the 7,065 prehistoric sites in the planning area, about 6.2 percent (438 sites) of the prehistoric sites have been recommended and formally determined to be ineligible for nomination to the NRHP, and approximately 11.5 percent (330 sites) of the 2,869 historic sites recorded in the planning area have been recommended and formally determined to be ineligible for nomination to the NRHP.

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 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 over 100 or more projects per year, with inventories covering approximately 15,000 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 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 national historic trails system, and the Custer Trail, Bismarck to Fort Keogh Trail, and Miles City to Deadwood Stage Trail (no site numbers) all 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 buffer zone is a management goal. Setting is also an essential aspect of NRHP eligibility for other cultural resource types such as rock art and American Indian sensitive sites and potential TCPs. However, it is not as important for some types of linear sites, such as canals and some roads.

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 (25 U.S.C. 3001 et seq.) 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. Third is the identification of areas in which Indian traditional practitioners collect plants or minerals. Finally, the issue of ensuring access to areas of traditional importance, as provided for by American Indian Religious Freedom Act (42 U.S.C. 1996). In some cases, these resource areas might also be eligible TCPs, requiring full compliance with NHPA, Section 106.

Prehistoric Sites

Since the majority of prehistoric sites in the planning area are defined as cultural material scatters, it is important to be able to identify potential discriminating elements that can be used to segregate such a large category of prehistoric resources into different use categories. A qualitative assessment of certain aspects of material culture (relative diversity and quantity of artifact materials) and complexity (spatial patterning of artifacts, presence or absence of features, presence or absence of buried deposits), coupled with a quantitative measure of site size (in acres) can be used to meet the purposes identified. These values will serve as indirect indicators of relative site function, relative duration of occupation, and research value and importance.

Important aspects of material culture include those described below.

- Artifact diversity, which is ethnobotanically, qualitatively measured from low to high and refers to the variety of cultural materials present (such as raw material types) and the variety of materials present (such as bone or stone).
- Artifact quantity, which is a qualitative measure intended to capture magnitudes of difference and refers to the relative quantity of material culture present (less than 50 items, hundreds, thousands).
- Site complexity, which is qualitatively measured from low to high and indicated by any spatial patterning in distribution of cultural material, the presence or absence of associated features, and the presence of buried deposits and stratigraphy.
- Site size, which is a quantitative measure that refers to the search for model patterns in overall site size that may reflect information such as site function and duration of occupation (these variables serve to distinguish between the smaller, more redundant and transient, limited-use cultural material scatters and the larger, longer-occupied camps, habitation sites, or extractive use locations).

Based on the model presented above, it is expected that the use categories would be reflected as outlined below.

- Scientific use refers to prehistoric sites that exhibit high diversity and large quantity (greater than 50 artifacts) of material culture, high complexity (spatial patterning of artifacts or activities, presence of features, stratified or buried deposits), and relatively larger size properties.
- Conservation use refers to rare sites or sites representative of functionally or temporally exceptional examples (in the planning area, these would include large quarry sites or sites with complex stratigraphic sequences).
- Traditional use designation follows consultation with American Indian groups and sites may reveal the significance of prehistoric site types that may include, but are not limited to, burial locations, rock art, effigies, other rock features, and vision quest locations.
- Public use sites are prehistoric sites that could be considered for public use (interpretation) in those few instances where interpretive potential is high and site integrity could be insured through protective measures (such uses should not be attempted without full consultation with interested American Indian groups, consequently, such prehistoric sites still require evaluation on a case-by-case basis).
- Experimental use or discharge from use refers to sites, which are individually evaluated prior to placement into these categories, with low diversity and limited quantity (less than 50) of artifacts, low or limited complexity, and small size (redundant small surface cultural material scatter and the information potential is exhausted with initial documentation).

Historic Sites

Unlike prehistoric resources, historic properties are more commonly determined to be significant for reasons other than their scientific value. Similarly, condition and integrity also tends to play a more obvious role in the evaluation of historic properties that contain architectural or structural remains. Historic resources in the planning area also vary greatly in size, function, and complexity, ranging from small homesteads to coal mines.

Classifications are reflected as described below (it should be noted that the defined use categories are not necessarily mutually exclusive, and many sites can be placed in the conservation use category, public use category, and possibly the scientific use category).

- The scientific use category includes historic sites with archeological and historical values but generally poor structural integrity (collapsed or deteriorated).
- The conservation use category includes historical sites that are rare or exceptional examples retaining integrity (these include well-preserved remnants of fur trading structures, military installations, or homesteads).
- The traditional use category includes historic sites that might encompass any sacred areas, TCPs, or

plant-gathering areas that were used historically by American Indian groups occupying the area (these sites would be determined in consultation with tribal representatives).

- The public use category includes historic sites where the interpretive potential is high and site integrity could be insured through protective measures (consideration is given those standing structures that could be preserved and maintained for adaptive reuse for administrative or recreational uses).
- Experimental use or discharge from use sites are evaluated on a case-by-case basis before assignment to either category. Only sites that have been formally determined not to be eligible for the NRHP are placed into either of these categories. In general, properties assigned to these categories are determined to contain little or no scientific or historical value (sites in these categories generally include isolated dumps and artifact scatters or isolated features such as collapsed structural remains that no longer retain integrity of design or workmanship).

Historical themes that lend themselves to interpretation for public use classification include those described below.

- Early exploration and Fur-Trade-era themes, including trading posts or forts, outposts, customs houses, trading grounds, trapping grounds, salt-extraction sites, portage or portage routes, river crossings or fords, and trails or trail campsites.
- Early exploration and Lewis and Clark Corps of Discovery themes, including post-contact earthlodge villages, portage or portage routes, forts, trading posts, campsites, and trading grounds.
- Mining and coal mining themes, including mining camps, dwellings, barracks, company towns, office buildings or storage buildings or yards, processing buildings, and loading or transportation facilities.
- Mining and uranium industry themes, including company offices.
- Military themes, including military reservations, forts, semi-permanent or trail camps, battlefields, military roads or trails, river crossings, and mail stations.
- Historic homesteading themes, including dwellings, barns, granaries, smokehouses, and stone or wood outbuildings.
- Historic ranching themes, including ranches, dwellings, outbuildings, stock-holding or stock-handling facilities, railroad yards, meat-processing facilities, and railroad spurs or haul roads.

Cultural properties are evaluated with reference to the NRHP criteria for the purposes of assessing their historical values and public significance; such evaluations are carefully considered when cultural properties are allocated to use categories. Although preservation and nomination properties must be weighted on a case-by-case basis, Table 3-26 serves as a general guide illustrating the relationship between NRHP evaluation and allocation to use categories.

PROPOSED CARTER MASTER LEASING PLAN AREA

The Carter MLP Area contains a low site density for the area. A total of 58 cultural sites have been recorded in the MLP area. No cultural sites have been recorded in four of the townships, although inventory has occurred. Cultural sites are about evenly divided between historic (31) and prehistoric (27). Approximately 40 percent of the cultural sites (24) are listed as not eligible for listing on the NRHP in the state historic preservation office CRIS (Cultural Resource Information System) database. No sites in the MLP area have been determined eligible for listing on the NRHP.

Previous Inventory

Most of the inventories for cultural resources have been for small range improvements, a few energy-related developments (well pads, flowlines), land exchanges, and a Class II coal planning inventory. There have been three large pipeline inventories crossing the MLP area: these are the Exxon Bairoil Carbon Dioxide Pipeline, the Grasslands Pipeline, and the Bison Pipeline. These three projects account for the discovery of 22 of the 60 cultural sites and the bulk of the formally evaluated sites for NRHP listing.

Overall, less than 5 percent of the MLP area has been systematically inventoried for cultural resources. Site density is low and is estimated to be one site per 6,600 acres, based on a figure of 396,650 acres for the MLP area. Density is lower than the 5 to 6 sites per section on BLM-administered lands for the overall planning area.

**TABLE 3-26.
GENERAL GUIDELINES FOR CULTURAL RESOURCE
USE CATEGORIES IN RELATION TO EVALUATION FOR INCLUSION ON THE
NATIONAL REGISTER OF HISTORIC PLACES**

Relationship Among Cultural Resource Use Categories, National Register Eligibility, and Preservation or National Register Nomination			
Cultural Resource Use Category	***National Register Eligibility***	***Preservation or National Register Nomination***	***Site Types Generally Included***
Scientific Use	Usually eligible (under Criterion d)	Long-term preservation not critical; medium National Register nomination priority.	**Prehistoric**: sites with high artifact count and diversity, high complexity, and larger size; **Historic**: sites with archeological and historical values, and generally poor structural integrity.
Conservation for Future Use	Always eligible (generally under Criteria a, c, or d and possibly Criterion b for historic sites)	Long-term preservation is required, highest nomination priority.	**Prehistoric**: sites inherently complex, rare, or fragile, and which exhibit exceptional scientific values (e.g. deeply stratified deposits, large quarries); **Historic**: sites inherently complex, rare, or fragile, generally significant standing structures (stabilization and preservation required).
Traditional Use	May be eligible (generally under Criteria a and d, possibly Criteria b and c)	Long-term preservation is desirable, nomination priority is determined in consultation with the appropriate cultural group(s).	Sites and locations determined in consultation with Tribal groups. **Prehistoric** may include: burial locations, rock art, effigies, other rock features, and vision quest locations; **Historic or Modern**: plant gathering locations, areas considered sacred for religious purposes, etc.
Public Use	Usually eligible (generally under Criteria a, b, and c, possibly Criterion d)	Long-term preservation is desirable, high nomination priority.	**Prehistoric**: high interpretive potential and can insure protection; **Historic**: high interpretive potential and stabilization, protection, or adaptive re-use can be ensured.
Experimental Use	May be eligible (generally under Criterion d, if at all)	Long-term preservation is not anticipated, low nomination priority.	**Prehistoric**: lithic scatters of limited artifact density and complexity; **Historic**: dumps, collapsed structures with no integrity or context.
Discharged from Management	Not eligible	Long-term preservation and management are not considerations, nomination is inappropriate.	**Prehistoric**: isolated finds, surface lithic scatters less than 50 items; **Historic**: isolated finds, dumps of less than 50 items, sites less than 50 years old.

Prehistoric Sites

The bulk of the 27 prehistoric sites are lithic scatters (17) or lithic scatters with fire-cracked rock (8). One site is described as a cairn site and one site is described as a lithic scatter and bison processing site. Two of the sites are attributed to the Middle Period, based on projectile points found on the surface. Both are listed as Pelican Lake Sites. The prehistoric period of the other sites is not known.

Historic Sites

The historic sites consist of 7 homesteads, 10 road segments or bridges, 2 sheep camps, 5 dumps, 1 historic well pad from the 1950s, and 1 site described as "other". Most of the homesteads, dumps, and sheep camps are evaluated as not eligible for NRHP listing.

PALEONTOLOGICAL RESOURCES

According to Section 6301 of the Paleontological Resources Protection Act (PRPA) of 2009 Omnibus Lands Bill, Subtitle D, 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…" (16 U.S.C. 470aa). Paleontological resources as defined under the PRPA do not include any paleontological resources found in context with archeological and cultural resources.
In the planning area, paleontological resources are strongly associated with the upper Cretaceous Hell Creek formation (where 80 percent of known locations in the state occur). The Tertiary Fort Union formation contains 14 percent of known paleontological localities. All other strata in eastern Montana contain less than 2 percent each of documented fossil localities. Of the 1,929 paleontological localities recorded in the planning area, 1,440 (75 percent) occur on BLM-administered land, 278 (14 percent) on private land, 153 (8 percent) on state land, 7 (less than 1 percent) on USFS land, 1 (less than 1 percent) on United States Army Corps of Engineers land, 1 (less than 1 percent) on other federal land, and 1 (less than 1 percent) on lands administered by the state and BLM. Landowner information for 48 of the paleontological localities (3 percent) is unknown because of ambiguous legal descriptions. No paleontological sites from the planning area have yet been listed on the NRHP. In the planning area, approximately 95 percent of the paleontological localities occur in counties where most of the Hell Creek and Fort Union formations outcrop; this includes Garfield, Carter, Dawson, McCone, Powder River, and Treasure counties. There are 1,805 vertebrate fossil localities (all ownerships) and 124 non-vertebrate localities in the planning area; non-vertebrate localities include 68 plant, 51 invertebrate, 1 plant and invertebrate, and 4 trace fossils (Aaberg et al. 2006).

Teeth are the hardest parts of a skeleton and the most commonly fossilized element of an animal; most localities produce only small fossils consisting of teeth and jaws, fragments of limb bones, and other small parts. Other dense bone portions, such as ends of limb bones and wrist and anklebones are also commonly preserved, while entire fossilized skeletons are extremely rare. Teeth and skulls are the most diagnostic and the most useful in species identification and research.

Fossil-bearing rocks occur throughout the planning area (Table 3-27 and Map 60). Although fossils are rare in most strata, three stratigraphic units that commonly occur in the planning area are known to contain significant fossil material. These units are the Upper Cretaceous Period Judith River formation, the Hell Creek and Lance formations (synonymous with and similar in time to the Hell Creek formation), and the Tertiary Period Tullock member (and its equivalent in the Ludlow member) of the Fort Union and Arikaree formations.

In Montana, the Judith River formation represents deposition in a shallow sea and on a coastal plain that contained river channels, freshwater swamps, and lakes. In addition to plant remains, many animal species are found in this formation, including mollusks, fish, amphibians, lizards, dinosaurs, other reptiles, and small mammals.

Meandering river channels and freshwater swamps that developed on broad delta plains were prevalent during the deposition of the Hell Creek and Lance formations (Flores 1992). The fossil record indicates a tropical to subtropical climate that supported a wide diversity of plant species. Mollusks, fish, amphibians, reptiles, dinosaurs (Triceratops, Anatosaurus, and Tyrannosaurus), other reptiles, birds, and small mammals are all abundant in the Hell Creek fossil record.

An important chronological event, the worldwide extinction of many life forms (including dinosaurs), and the beginning of rapid mammal evolution, is represented at the contact of the Hell Creek and Fort Union formations. The Fort Union formation is divided into three members in ascending order: the Tullock, Lebo, and Tongue River members.

TABLE 3-27.
FOSSIL-BEARING ROCKS AND THEIR ACREAGE ON PUBLIC LANDS IN THE PLANNING AREA

Geologic Rock Unit	Percentage of Formation on Public Lands	Acres of Public Lands
Judith River formation	15.06	462,877
Hell Creek formation	2.5	4,723
Fort Union formation (Tullock member)	12.44	236,038
Total		**702,638**

A wide variety of plant fossils are found throughout the Fort Union formation and indicate an environment characterized by an alluvial plain that contained river channels, expansive flood-basin swamps, and lakes (Belt, Sakimoto, and Rockwell 1992). Channel fill deposits contain an abundance of freshwater clams and snails, while the most significant fossils (turtle, fish, reptile, and mammal) are found primarily in the Tullock member of the Fort Union formation. The Tullock member contains fish, amphibian, turtle, champsosaur, lizard, crocodilian, mammal, bird, and plant remains. Fossils from the Hell Creek formation and Tullock member, particularly in Garfield and McCone counties, are instrumental in studies examining the mass extinction event represented at the Cretaceous-Tertiary boundary (Clemens 2002).

The Miocene Arikaree formation has produced fish, bird, and mammal fossils. This formation has a low fossil potential, but there is a high probability that its fossils would be considered significant (Aaberg et al. 2006).

There are no paleontological localities within the planning area formally listed on the NRHP. Paleontological localities are not usually considered eligible as individual fossil localities but they may be eligible under NRHP criteria A, B, and D for other reasons (e.g., the development of paleontology in Montana, association with important events such as exploration surveys, and association with significant paleontologists, or their contribution to understanding the prehistory of an area). In the planning area, there are several National Natural Landmarks (NNLs) and ACECs that recognize significant paleontological areas (see *Special Designation Areas*). NNLs include Hell Creek, Bug Creek, and Capitol Rock and ACECs include Hell Creek, Bug Creek, Sand Arroyo, and Ash Creek Divide.

The planning area contains some of the richest paleontological resources in the world; nearly every major museum in the United States has at least one dinosaur exhibit from this area. The Hell Creek formation contains the best examples of the last period of the age of dinosaurs in the United States, and, together with the Tullock member, exhibits an uninterrupted sequence encompassing the last era of the dinosaurs, their extinction, and the subsequent beginning of the age of mammals. Beginning in 1903, these formations have been the subject and source of much research. There are other areas containing high concentrations of significant paleontological values; many of these individual localities will also continue to produce significant amounts of paleontological data.

The source of paleontological value in the planning area is attributed to a combination of factors and most important is surface exposure of fossil-bearing strata. Because most fossils are recovered as scattered surface finds, visibility of the outcrop is an important factor in fossil recovery. The climate in eastern Montana often exposes, instead of covering, these units. Lack of vegetative cover also enhances the visibility. Exposures that produce significant fossils, particularly vertebrate fossils, are rare, and therefore, are of considerable scientific value and interest. Several sites in the planning area have yielded the only known fossil record for various extinct animals.

On average, MCFO issues approximately 10 to 15 resource use permits and excavation permits to qualified researchers on an annual basis. Typical excavations cover approximately 0.5 acres and combined, they contribute to between 5 to 7.5 acres being disturbed annually. Approximately 95 percent of the 1,929 paleontological sites or localities in the MCFO unit occur in Garfield, Carter, Dawson, McCone, Powder River, and Treasure counties. The Hell Creek formation is the most fossiliferous unit in the planning area, and it accounts for approximately 80 percent (1,543) of the documented sites or localities. The Fort Union formation contains 14 percent (271) of the documented sites or localities, with at least 74 percent of these occurring in the Tullock member. Of the 1,929 documented sites or localities, 1,805 are vertebrate fossil localities.

SPECIMEN COLLECTION

Existing regulations and policies address the fossil collection on public lands (see *Paleontological Resources Appendix*). Some areas may be closed for hobby collecting to protect scientifically significant invertebrate or plant fossils or to prevent other potential resource damage. Although qualified paleontologists may obtain permits for collecting vertebrate fossils and other scientifically significant specimens, specimens collected under the backing of a permit remain the property of the federal government and must be kept properly in a qualified museum or university collection.

Paleontological Resources, Condition and Trend

Paleontological localities are subject to damage, destruction, or loss from surface disturbance associated with commercial construction or development projects but also from amateur collectors and rock hounds. Although some of these enthusiasts are aware of the scientific value of their finds, many are not. Although interest in vertebrate fossils draws many people into the field of fossil collection, demand fueled by high prices obtained for some fossil specimens also generates interest. Specimens collected for sale to the public often lose their scientific value because important, associated data regarding the location and context are not recorded or preserved and the specimens are often not made available to the scientific community.

The scientific value of a fossil specimen can be diminished by improper recovery, improper reconstruction and storage, or by failure of the collector to record precise location and stratigraphic data in the field. Damage or destruction of paleontological resources, an inherently nonrenewable asset, results in the permanent loss of these resources for future scientific research or public enjoyment. Because dirt bikes and all-terrain vehicles (ATV) have damaged some fossil localities, inadvertent damage is a concern. OHV use continues to provide access to remote outcrops and collecting localities. These sites are vulnerable to destruction by off-road travel. Motorized wheeled travel allows vandalism of fossils that might otherwise be too heavy or awkward to pack out on foot (BLM 2003m).Compounding the factors described above, a significant amount of land administered by BLM represent badlands topography, resulting in large exposures of strata and contributing to a higher probability for the discovery of fossil localities.

The condition and trend of paleontological resources in the planning area varies considerably because of past and present land use patterns and diversity of terrain, geomorphology, access, and visibility. Exposed fossil elements can be easily damaged by numerous factors, including wind and water erosion, animal and human intrusion, natural deterioration, and commercial development and maintenance activities. Evidence of vandalism or illegal collecting has been observed on limited occasions in the planning area. Commercial development and maintenance activities (e.g., accelerated erosion attributable to some grazing, mining, and recreation activities) are known to affect certain fossil localities.

Based on known research interests of professional paleontologists and the increase in private-prospecting arrangements throughout the planning area, the demand for paleontological resources is considered high to very high in the planning area.

PROPOSED CARTER MASTER LEASING PLAN AREA

The area contains 19 paleontological localities. Most of the paleontological localities are invertebrate localities (9) and most of the vertebrate localities consist of small vertebrate localities (fish). Almost all of the localities are reported from the Pierre shale formation. Two localities are reported in the Oligocene Brule member of the Arikaree formation.

VISUAL RESOURCES

The objective of VRM is to manage public lands in a manner that will protect the quality of the scenic (visual) values of these lands, manage the quality of the visual environment, and reduce the visual impact of development activities while maintaining the viability of all resource programs. By law, BLM is responsible for managing public lands for multiple uses and ensuring that the scenic values of these public lands are considered before allowing uses that may have negative visual impacts. Public lands have a variety of visual values and warrant different levels of management. VRM is used to systematically identify and evaluate these values to determine the appropriate management objectives and design activities to meet those objectives. The VRM process involves inventorying scenic values, establishing management objectives for those values through the resource management planning process, and evaluating proposed activities to analyze effects and develop mitigations to meet established VRM objectives.

VRI CLASSES

Visual resource inventory (VRI) is an inventory of all public lands and is prepared and maintained on a continual basis. The inventory stage serves to identify the visual resources of an area and assign these resources to an inventory class using the VRI process. The process consists of a scenic quality evaluation to rate the visual appeal of an area, a sensitivity level analysis to assess public concern of an area's scenic quality and their sensitivity to potential changes in the visual setting, and a delineation of distance zones to indicate the relative visibility of the landscape from primary travel routes or observation points.

Based on these three factors, BLM-administered lands are placed into one of three VRI classes: Class II, Class III, and Class IV. These three classes represent the relative value of the visual resource and provide the basis for considering visual values in the resource management planning process. VRI classes II, III, and IV are determined based on a combination of the scenic quality, sensitivity level, and distance zone overlays. In the relative scale of visual values, Class II has a higher value than Class III, which is moderately valued. Class IV is the least valued. Class I is assigned to special management areas in which a management decision has previously been made to maintain a natural landscape; these areas are the most valued landscapes. VRI classes are informational in nature and do not establish management direction.

The scenic quality rating is the result of summing the scores of the seven analysis factors on the scenic quality form and assigning the rating based on points according to the following schedule:

- Class A: a score of 19 points or more,
- Class B: a score of 12 to 18 points, and
- Class C: a score of 11 points or less.

The MCFO had a total of 63 scenic quality rating units (Map 61). Of the 63, two received a Class A rating: the Seven Blackfoot Area and the Musselshell River Area, which composes 1.6 percent of the planning area. The scenic quality in these areas scored high because of the variety of color and vegetation present, which is enhanced by adjacent scenery.

The majority of units were in the range of 11.5 to 18, which placed them in Class B for scenic quality. Many of the units encompass river valleys and areas with variable topographic relief. Thirty-three units (29.4 percent) of the analysis area fell within a Class B. The remaining scenic quality rating unit received a Class C scenic quality rating, with scores in the range of 11 or less. These units generally included flat to rolling landforms and covered large areas throughout the analysis area. In total, 28 units (70 percent of the analysis area) were rated Class C.

The evaluation of the sensitivity levels in the VRM process provides a measure and an indication of the public's concern for scenic quality (Map 62). In this part of the process, public lands are assigned high, moderate, or low sensitivity levels by analyzing certain factors that contribute to the public's overall concern of an area's scenic quality. These factors include types of users, amount of use, public interest, adjacent land use, special areas, and other factors such as research or studies. BLM staff with detailed knowledge of the use of public lands in their field office carefully and subjectively consider all of the above factors to determine the overall sensitivity level of an area. Both the rating of individual factors and the relationship between factors are analyzed in determining the overall rating of an area. Multidisciplinary teams of BLM staff and management completed sensitivity level ratings. The teams discussed the general use patterns and activities on public lands and then used this information to delineate the boundaries of the rating units on a map of the affected area. Once the preliminary boundaries were identified, the teams evaluated each unit based on the sensitivity rating factors and assigned an overall rating to the units. Unit boundaries were modified as needed based on the discussions, and ratings were recorded and entered into a geodatabase. Sensitivity levels in the MCFO analysis area were higher in the southern and northern portions because they contain higher recreational value (including hunting) because of the variable topography and vegetation.

Although the analysis of distance zones considers the distance from which the area is generally viewed, it does not take into account every possible viewing location. Landscape areas are generally divided into three distance zones based on their relative visibility from travel routes or other observation points: foreground-middleground zone, background zone, and seldom seen zone (Map 63). Areas that are more visible to the public are more noticeable and may precipitate the public's concern for visual quality. Boundaries of the distance zones may also assist in defining the boundaries of an area's sensitivity level rating unit. This process was completed using GIS, primary travel routes, and other potentially sensitive viewpoints such as recreation areas and scenic roads. The majority of the lands within the MCFO are in the foreground-middleground or background zones.

The VRI classes are then mapped by overlaying the scenic quality, sensitivity levels, and distance zones in GIS. The majority of the MCFO analysis area, approximately 65 percent, was designated as VRI Class IV. VRI Class II accounts for approximately 11 percent, and VRI Class III accounts for 24 percent. The remaining 0.4 percent of the MCFO is designated as VRI Class I.

VRM CLASSES

A VRM system identifies and evaluates an area's scenic values to determine the appropriate management objectives for those values. Visual management objectives are developed through the RMP planning process and reflect the resource allocation decisions made in the RMP. Although VRM classes might reflect VRI classes, they might not because management objectives for other resources as determined in the planning process might require different visual management needs. A VRM Class I is an area that receives the most protection for visual values, while a VRM Class IV receives the most limited protection from visual intrusions.

The VRM system is a two-part process that includes an inventory phase and an analysis phase. The inventory phase (updated in 2011) identifies the visual resources of an area and assigns them to inventory classes. The visual values identified through the inventory process are considered throughout the planning process, and the area's visual resources are then assigned to VRM management classes with established objectives (Table 3-28). The analysis phase is project specific, and determines whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives established for the area or whether design adjustments or mitigation stipulations will be required. All actions proposed during the management planning process that would result in surface disturbance must consider the importance of the visual values and the impacts the project may have on those values. A visual contrast rating system is used for this analysis, which involves comparing the project features with the major features in the existing landscape to determine if the scenic values of the area have been maintained.

The planning area being managed under the current RMPs contains 97,000 acres of VRM Class I; 400,000 acres of VRM Class II; 380,000 acres of VRM Class III; and 1.9 million acres of VRM Class IV.

CONDITION

With the exception of a few large parcels, public lands in the planning area are scattered among private, local, state, and federally owned lands. Rolling hillsides are the dominant landscape but there are also isolated rock outcrops, woody draws, forested coulees, ponderosa pine, and juniper stands, riparian and wetlands, hardwood river bottoms, badlands, and river breaks and all possess unique visual qualities, character, and natural beauty.

VRM Class I areas within the MCFO includes the seven wilderness study areas (WSAs). Notable VRM Class II areas in the planning area are river corridors of the Yellowstone, Missouri, and Powder rivers, large areas abutting the Charles M. Russell National Wildlife Refuge, and the Finger Buttes ACEC in Carter County. Finger Buttes has been designated an ACEC for unique scenic values that do not exist elsewhere in the region (BLM 1999a), although there is no legal access into the area. Interstate 94 and State Road 12, both VRM Class II landscapes, are the major east-west transportation routes for tourists and residents, providing access to recreation opportunities and views along the rivers. The Lewis and Clark Special Recreation Management Area (SRMA), which includes lands next to the Yellowstone River and portions of the Missouri River, are also within a VRM Class II area.

TRENDS

The planning area still maintains much of the scenic quality and pristine viewsheds encountered over the past 25 years. The prevalence of grazing in the planning area and the open spaces afforded by an agriculture economy have prevented major change to date but the trend in rural development and subdivision, especially in areas in close proximity to public lands, may forecast more rapid change in the future.

TABLE 3-28.
VISUAL RESOURCE MANAGEMENT CLASS OBJECTIVES

Class	Management Objectives
I	The objective of this class is to preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention. This class provides for natural ecological changes, but this does not preclude very limited management activity.
II	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. Activities or modifications of the environment should not be evident or attract the attention of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
III	The objective of this class is to retain partially 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 caused by management activities may be evident, but should not detract from the existing landscape.
IV	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 a major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of basic elements.

There have been visual intrusions involving concentrated development such as buildings, infrastructures associated with oil and gas fields and CBNG development, and ROWs involving surface disturbance (e.g., utilities). Surface-disturbing activities associated with these areas are readily noticeable because of the contrast with the representative landscape. Visual mitigation of these activities has prevented development activities from exceeding the established VRM objectives within these areas. However, the trend toward continued expansion of natural resource development is creating areas of potential conflict between the surface-disturbing activities and established VRM class objectives. Other visual intrusions, which include range improvements, fences, two-track roads, and areas receiving concentrated recreational use, are located throughout the planning area. An increasing number of recreationists seeking various types of recreational opportunities are becoming more aware of scenic values.

LANDS WITH WILDERNESS CHARACTERISTICS

WILDERNESS CHARACTERISTICS

The BLM maintains an inventory of all lands under its jurisdiction, pursuant to Section 201 of FLPMA. As required by law, the BLM will continue to maintain inventories of lands under its jurisdiction, including lands with wilderness characteristics. In addition, consistent with FLPMA and other applicable authorities, the BLM will consider the wilderness characteristics of BLM-administered land when undertaking its multiple-use land use planning.

The original inventory was completed in the 1980s, and is known as the Montana Wilderness Inventory. The existing inventory of BLM-administered land in the planning area was updated and evaluated to determine if lands other than the existing WSAs have wilderness characteristics (BLM 2011b). Areas of public land over 5,000 acres were mapped (Map 64). Using GIS data and the original 1980s inventory, the interdisciplinary team compared polygons to areas including those previously inventoried. A review of all of the polygons occurred using updated guidance and criteria (BLM 2011b and BLM Manual 6302, *Consideration of Lands with Wilderness Characteristics in the Land Use Planning Process*) (Map 65). Additional data and local specialist knowledge were obtained for 26 new polygons. The interdisciplinary team reviewed each polygon for physical intrusions such as roads, two-tracks, reservoirs, cattleguards, pipelines, fences, oil and gas wells, buildings, or any other project that has occurred on BLM-administered land using GIS and collaborated with other specialists as needed. Updated forms were completed for each of the polygons and previously reviewed areas. During this process, the ID team determined that two areas, one within the Terry Badlands WSA and another in the Devil's Creek Common area along the Missouri River contain wilderness characteristics (Maps 66 and 67).

The Terry Badlands lands with wilderness characteristics area (MT-024-684) consists of three sections of acquired lands, which were private inholdings at the time the Terry Badlands WSA was studied for wilderness potential. They consist of 1,960 acres of public land located 3 miles northwest of Terry, Montana, in Prairie County. The three sections are all within the northern portion of the Terry Badlands WSA.

The three sections consist of banded, colorful cliffs overlooking rolling prairie vegetated with prairie grasses, native legumes, and scattered juniper. One of the nation's most easterly stands of limber pine is located in the northwestern portion of the WSA. Steep, eroded slopes, divided by deep gullies, are also present within the sections along with rough hillsides, buttes, tabletops, spires, and scoria escarpments, which rise to meet rolling benches north of the Yellowstone River. All three sections contain spectacular badlands and have the characteristics for naturalness and outstanding opportunities for solitude and primitive recreation. The lands demonstrate lands with wilderness characteristics.

The Devils Creek Common area (MT-020-039) is in northern Garfield County and consists of approximately 5,236 acres. The area is 32 miles northwest of Jordan, Montana. Private land borders BLM-administered public land on the south, west, and east sides and the Charles M. Russell National Wildlife Refuge borders the northern edge. There is one state section bordering the southeast portion of the unit. Devil's Creek drainage runs through the middle of the unit. Other, unnamed tributaries are within the unit, which create heavily dissected terrain.

Although the unit contains only BLM-administered public lands, there is no vehicular public access because private lands need to be crossed to gain entry to the unit; however, walk-in public access is available through the Charles M. Russell National Wildlife Refuge land to the north. The topography is heavily dissected and rough with steep buttes and mesas. Ponderosa pine and juniper are evident in dense stands throughout the unit, as well as range grasses, native legumes, and sage. With the exception of two reservoirs, there are very few human-made developments in the unit; however, these developments are not easily noticed. Off-site impacts occurring in the unit include ranch-related developments and activity on the periphery of the unit. The entire unit has the characteristics of size, naturalness, and outstanding opportunities for solitude and primitive recreation. The northern portion of the unit is contiguous with Charles M. Russell National Wildlife Refuge lands, which has similar characteristics and management.

The MCFO will continually update the inventory based on more accurate GIS information and field visits. Areas with wilderness characteristics must possess sufficient size, naturalness, and outstanding opportunities for either solitude or primitive and unconfined recreation. In addition, it may also possess supplemental values.

RESOURCE USES

This section contains a description of the existing human uses of resources in the planning area and follows the order of topics addressed in Chapter 2. These topics are as follows:

- Facilities,
- Forestry and Woodland Products,
- Livestock Grazing,
- Minerals,
    - Geology,
    - Coal,
    - Oil and Gas,
    - Geothermal,
    - Locatable Minerals,
    - Mineral Materials,
- Recreation,
    - Recreation Management Areas,
- Renewable Energy,
- Transportation,
- Travel Management and OHV Use, and
- Lands and Realty.

FACILITIES

This section describes facilities (administrative, recreation and communication facilities, and hazard class dams), maintenance, and construction. Five administrative sites are within the planning area: the main administrative compound in Miles City; the Miles City Airbase at Frank Wiley Field in Miles City; the Jordan Fire Station in Jordan; the Camp Crook Fire Station in Camp Crook, South Dakota; and the Ekalaka Field Station in Ekalaka. The administrative sites are extensive and include a multitude of assets such as office space, warehouses, wareyards, parking, and storage facilities.

There are 13 recreation sites across the planning area. The recreation sites vary in nature and complexity from sites with kiosks to sites that contain multiple assets such as site roads, vault toilets, campsites, or picnic areas. The planning area contains nine communication sites.

The USDI requires all sites in facilities asset management have a comprehensive condition assessment of each locational asset and asset feature performed every 5 years and a periodic review performed at least once in the interim. These reviews or assessments identify both annual and deferred maintenance needs. All sites are maintained annually on an as needed basis.

The BLM also has a 5-year plan, which provides funding on deferred maintenance and capital improvement assets. This Bureau-wide funding addresses high priority backlog maintenance needs and new construction projects.

HAZARD CLASS DAMS

All BLM-administered hazard classified dams are maintained to standards that promote safe performance and reduce hazards resulting from the dam's possible failure to an acceptable level. Dams are classified for hazard potential (low, significant, or high) based on probable loss of downstream life and property. The hazard potential classification is based on the degree of adverse incremental consequences from failure or operational problems of the dam as well as the size of the structure. The planning area has 51 low hazard dams and no high or significant hazard class dams.

Low hazard class dams have Comprehensive Condition Assessments performed every 5 years. The dams are managed and maintained in accordance with current regulatory requirements.

FORESTRY AND WOODLAND PRODUCTS

Coniferous forest habitat types occurring in the planning area include ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (J*uniperous scopulorum*), Douglas-fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*). Deciduous forest habitat types include green ash (*Fraxinus pennsylvanica*), quaking aspen (*Populus tremuloides*), boxelder (*Acer negundo*), and bur oak (*Quercus macrocarpa*) (Hansen, Thompson, Massey, and Thompson 2008). Ponderosa pine forest types occur on the majority of the planning area forestlands.

Moisture (along with soil type, nutrient availability, plant density, topography, and climate) is one of the most important factors affecting plant growth. Lack of moisture can have a pronounced influence on overall productivity. This is particularly true in the dry expanses of the northern Great Plains. In the planning area, the habitat types of the ponderosa pine series occur along a moisture gradient (where the graminoid-dominated habitat types are drier than the shrub-dominated habitat types). Within the graminoid-dominated habitat types, the following moisture gradient is present (from dry to wet) (Hansen et al. 2008):

- ponderosa pine/bluebunch wheatgrass habitat type,
- ponderosa pine/sun sedge (*Carex heliophila*) habitat type, and
- ponderosa pine/Idaho fescue (*Festuca idahoensis*) habitat type.

Within the shrub-dominated habitat types, the following moisture gradient is present (from dry to wet) (Hansen et al. 2008):

- ponderosa pine/white coralberry (*Symphoricarpos albus)* habitat type,
- ponderosa pine/common juniper (*Juniperus communis*) habitat type,
- ponderosa pine/chokecherry (*Prunus virginiana*), and
- ponderosa pine/red-osier dogwood (*Cornus stolonifera*) habitat type.

There are six distinct geographic or geologic areas where most of the forestlands occur in the planning area (geological characteristics generally define the location of forestlands) (Table 3-29). These six distinct areas are described below.

(1) The Missouri Breaks in Garfield County
This area is characterized by two distinct conditions: areas with exposed shale dominated by Rocky Mountain juniper with scattered ponderosa pine and knobs of deeper soils dominated by ponderosa pine and scattered Douglas-fir trees.

(2) Areas south of the Yellowstone River
This area has forestlands on knobs where soils are loamy with a high percentage of coarse fragments. Soils are shallow to deep, and elevations vary from 2,300 feet in the areas southwest of Miles City to 4,200 feet near the Wyoming border. Areas east of Miles City (Knowlton and Pine Hills) along the Powder River have slightly higher elevations and higher precipitation than the Rosebud County area. Areas in western Custer County and eastern Rosebud County have the lowest elevations and precipitation. This area includes the Moon Creek and Rosebud Creek drainages.

(3) Ekalaka Hills-Chalk Buttes in Carter County
These areas have generally sandy soils developed from sandstones and siltstones and a medium percentage of coarse fragments. Precipitation averages 16 to 18 inches per year and elevations range from 3,500 to 4,100 feet.

(4) Cedar Creek Anticline
This area of exposed shale is located between Baker and Glendive. Juniper habitat types are present, and juniper is the dominant cover type.

(5) Terry Badlands
This area is located north of the Yellowstone River near Terry and contains a unique cover type of limber pine that also contains ponderosa pine and Rocky Mountain juniper.

(6) Areas north of the Yellowstone River
This area is located north of the Yellowstone River with scattered ponderosa pine and juniper trees occurring on sandy loam soils.

FR/CC is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels, and disturbance regimes (Hann et al. 2008). The FR/CC describes the differences between current vegetation composition and structure and pre-European settlement reference conditions. Assessing FR/CC helps guide management objectives and set priorities for treatments. Based on percentage departure from average pre-settlement reference conditions, the FR/CC is divided into three categories:

TABLE 3-29.
FORESTLANDS BY GEOLOGIC OR GEOGRAPHIC AREA

Area Name	BLM-administered Acres of Forestlands Within Areas			BLM-administered Acres of Forestlands Available for Treatment (outside of WSAs)		
	Conifer	**Hardwood**	**Total**	**Conifer**	**Hardwood**	**Total**
Ekalaka Hills/Chalk Buttes	2,607	2,233	4,840	2,607	2,233	4,840
South of Yellowstone	56,383	35,180	91,562	52,257	34,749	87,006
Cedar Creek Anticline	9,228	3,168	12,395	9,228	3,168	12,395
Missouri Breaks	35,677	8,293	43,970	26,981	7,091	34,072
North of Yellowstone	3,372	10,655	14,027	3,372	10,655	14,027
Terry Badlands	212	308	520	15	82	98
Total	**107,478**	**59,836**	**167,315**	**94,460**	**57,978**	**152,438**

USFS and USDI (LANDFIRE) data

- FR/CC 1: 0 to 33 percent departure;
- FR/CC 2: 34 to 66 percent departure, and
- FR/CC 3: 67 to 100 percent departure.

Forests and woodlands in FR/CC 1 have frequent fire return intervals and stand structures characteristic of pre-settlement conditions. Both forest and fire management activities designed to reduce ladder fuels and understory vegetation buildup lower the FR/CC of a treatment area. Forests and woodlands in FR/CC 1 are productive, diverse, vigorous, and resilient to disturbances (e.g., wildfire, insects, and disease). These areas typically experience insect and disease activity at endemic, not epidemic levels. In contrast, forests and woodlands in FR/CC 2 and FR/CC 3 are overstocked and experience infrequent fire return intervals. Species compositions and dense stand structures are uncharacteristic of pre-settlement conditions and trees experience increased competition for growing space (e.g., sunlight, water, nutrients); therefore, these forests and woodlands are less resilient to disturbances and are at risk of stand-replacing wildfires, epidemic level insect and disease outbreaks, or both.

Fire was a key element in shaping ponderosa pine forests in the planning area prior to European settlement. Historically, forested areas of southeastern Montana experienced fire return intervals of 35 to 40 years (Arno and Gruell 1983). High-frequency, low-intensity fires kept forests open and park-like and removed competing understory vegetation and down material, which resulted in irregularly shaped patches and groups of trees that varied in age, size, and density across the landscape. However, fire suppression practices since the early 1900s have resulted in most forest types and woodlands being classified in FR/CC 2 and FR/CC 3 (Map 67) categories, which deviate from the pre-European settlement Historic Range of Variability (Clark and Sampson 1995) for species composition, stand structure, fire frequency and intensity, and fire size. Fire suppression practices have caused changes that include:

- reduced tree growth,
- stagnated nutrient cycles,
- increased risk of insect and disease activity,
- increased hazardous fuel loadings,
- increased vertical fuel continuity,
- changes in canopy cover and increased stand density,
- increased risk and severity of wildfires,
- fewer and smaller canopy openings,
- shifts in habitat diversity, and
- changes in visual appearance and aesthetics.

Climate strongly affects forest productivity and species composition. In addition to the direct effects of climate on tree growth, climate also affects the frequency and intensity of natural disturbances such as fire, insect outbreaks, ice storms, and windstorms. Because different species may respond somewhat differently to warming, the competitive balance of species in forests may change. Trees will probably become established in formerly colder habitats (more northerly, higher altitude) than at present (Backlund et al. 2008).

Higher spring and summer temperatures and earlier snowmelt are extending the wildfire season and increasing the intensity of wildfires in the western United States (Running 2006). "In our part of the world, we can say conclusively that climate change is accelerating wildfire trends. We have to be ready for more active fire seasons more often," said Steven Running, a University of Montana forestry professor and Nobel laureate for his work as a member of the IPCC (Blue 2008, n.p.). The overall importance of climate in wildfire activity underscores the urgency of ecological restoration and fuels management to reduce wildfire hazards to human communities and to mitigate ecological impacts of climate change in forests that have undergone substantial alterations due to past land uses (Westerling, Hidalgo, Cayan, and Swetnam 2006a).

Climate change also affects insect populations that damage and kill trees. When climatic conditions cycle into warmer and drier trends, beetle populations are favored with less winter mortality and faster and better reproductive cycles (Kolb 2009). According to Diana Six, an entomologist at the University of Montana, "A couple of degrees warmer could create multiple generations a year…If that happens, I expect it would be a disaster for all of our pine populations" (Robbins 2010, n.p.). Jesse Logan, a research entomologist for the USFS Rocky Mountain Research Station, built on the work of other beetle researchers and created a complex computer model of bark beetle behavior. The model showed that cold temperatures at higher elevations made it impossible for mountain pine beetles to complete their life cycle in 1 year, forcing them to confront a second winter at a vulnerable point in their development, thereby keeping beetle populations at relatively low levels. However, when Logan increased the global mean temperature by 2 degrees in the model, beetles raced through a 1-year life cycle at higher elevations. According to Logan, "they also synchronized their emergence, allowing them to join forces and overwhelm tree defenses. High-mountain mass attack – and mass tree death – suddenly became possible" (Nijhuis 2004, n.p.).

Plains island forests (refugia of trees and tree-dependent species isolated in a grassland matrix) are at significant risk from climate changes because they are ecotone systems (borderline between grassland and forest ecosystems) and therefore sensitive to relatively small changes in environmental conditions. In addition, because island forests are relatively small ecosystems, they may exhibit reduced genetic diversity and greater vulnerability to catastrophic disturbance such as wildfire, pathogen attacks, or severe drought (Henderson, Hogg, Barrow, and Dolter 2002).

The issue of climate change exacerbates the current forest health problem in southeast Montana. Forest and woodland health within the planning area will continue to deteriorate without implementation of silvicultural treatments to reduce fuel accumulations and restore existing stands to desired conditions by improving the overall vigor, productivity, and resiliency of forested vegetation. Low-intensity prescribed burns and thinning of small diameter trees would be an important management tool for ponderosa pine stands. Such activities reduce fuel loads and ladder fuels, decreasing the likelihood and intensity of crown fires, aiding nutrient cycling, and improving seedbeds and productivity of understory species (Howard 2003).

FOREST PRODUCTS

Most forested lands in the planning area occur in small isolated parcels with poor access, low volumes per acre, and limited values. Consequently, the sale and harvest of wood products has primarily occurred through small, negotiated sales.

Salvage logging near Swain Creek in the planning area

Forest products harvested within the planning area have historically accounted for less than 5 percent of total harvest volume in Montana (Keegan et al. 2001). Most harvesting has occurred on private ownerships and been supplemented by harvests from federal, state, and tribal lands. Since 1999, annual harvest levels from private lands within planning area counties have averaged 22 million board feet, representing approximately 73 percent of total harvest volume (S. Hayes, personal communication, May 17, 2010). The predominant product harvested has been sawlogs and other commercial products reported include house logs, pulpwood, residue (biomass), veneer logs, and post and poles. Most forest products are exported out of the planning area for processing in western Montana, Wyoming, and South Dakota because southeast Montana lacks a wood product manufacturing infrastructure. However, transportation costs to deliver products to these long distance markets are generally prohibitive.

Forest product usage has been incidental on BLM-administered lands. Since 2000, only one commercial timber sale (a fire salvage totaling 621,000 board feet) was harvested. Green and mostly fire-killed sawlogs from this sale were delivered to a mill in northern Wyoming. About 60 permits per year have been issued for other forest products; including Christmas trees, fuel wood, and post and rail material. Non-sawlog products are typically used by the permittee for personal or ranch use. Sales of house logs, residue (biomass), and veneer logs have not occurred on BLM-administered lands in the planning area.

Biomass

Long distances to pulpwood processing facilities and low-return pulp markets have contributed to sporadic to non-existent use of small diameter forest material. Some of this material has been removed through personal use firewood permits and is directly related to the distance from larger population centers. Use of this material for biomass-related energy production has not been a factor and no such facility currently exists in the region. However, the Eastern Montana Biomass Task Force is currently studying the potential for such material from the existing forested land base (on all ownerships). Use of small diameter wood products or residue is encouraged by the BLM.

LIVESTOCK GRAZING

GRAZING ALLOTMENTS

The MCFO is responsible for administering livestock grazing on BLM-administered surface across the planning area. These BLM-administered lands are usually intermingled with private and state lands, which are grazed as one unit. The MCFO administers 1,776 grazing allotments comprising approximately 2,736,673 public acres and 546,570 public animal unit months (AUMs) (BLM 2007f; Map 16 on Map CD). Cattle are the predominant class of livestock authorized, which are generally cow-calf pairs (calves are sold at weaning). Most yearlings are replacement heifers. According to the Rangeland Administration System, permitted allocations include cattle on 1,728 allotments, sheep on 132 allotments, horses on 101 allotments, yearling cattle on 33 allotments, bison on 3 allotments, and burros on 1 allotment (BLM 2007f). There are 34 allotments (2 percent) with more than 10,000 acres, and 1,110 allotments (63 percent) with less than 1,000 acres, while the remaining 632 allotments (35 percent) are between 1,000 and 10,000 acres in size.

GRAZING HISTORY

The history of the BLM began in 1934 prior to its formation; prior to establishment of the BLM, the General Land Office managed grazing on public lands outside forest perimeters (Resource Concepts, Inc. 2001). The passage of the 1934 Taylor Grazing Act initiated broad management of these lands with the establishment of the Grazing Service, and directed establishment of a permit system, organization of grazing districts, fee assessment, and consultation with local advisory boards. The melding of the Grazing Service and the General Land Office in 1946 created the BLM.

Shifts in public attitudes about the use of public land in the late 1960s and early 1970s occurred concurrently with the passage of NEPA in 1969, which directed land managers to consider the environmental consequences of activities on federal lands (Resource Concepts, Inc. 2001). Subsequent to the NEPA and the 1973 *Natural Resources Defense Council v. BLM* decision, EISs, which were developed in part to address grazing and to develop an approach to meet long-term goals of public lands grazing, were prepared for every BLM-administered resource area.

The passage of FLPMA in 1976, which requires multiple-use management of lands in the public domain, also reconfirmed the BLM’s ability to reduce livestock numbers if necessary (Resource Concepts, Inc. 2001). Incorporating the development of allotment management plans (AMPs) into the permit process, cooperation and coordination with grazing permittees during the preparation of these plans was included in FLPMA. The 1978 Public Rangeland Improvement Act established a grazing fee formula to set annual fees for grazing on public lands.

In 1986, a management approach was initiated with the goal of monitoring the long-term and short-term effects of grazing (Resource Concepts, Inc. 2001). The objective of monitoring was to provide a long-term database that would allow for the identification of specific problem areas and management actions necessary to correct those problems. The method implemented was an allotment evaluation process with a 3- to 5-year data compilation interval.

In August 1995, Rangeland Reform ’94, which required the establishment of standards and guidelines to achieve properly functioning ecosystems in upland and riparian areas, changed the BLM’s methods and administrative procedures used to manage public lands (Resource Concepts, Inc. 2001). However, litigation has prevented substantial changes to these regulations although some has been proposed. The Secretary of the Interior approved grazing Standards and Guidelines for Montana/Dakotas on August 12, 1997 (BLM 1997c).

Management Era (Mid-1960s to 1980)

BLM grazing permits were adjudicated, which reviewed the limiting factors described below and established the extent of historical grazing, occurred from the mid-1950s to the late 1960s (Resource Concepts, Inc. 2001).

- Priority use: priority grazing use prior to the Taylor Grazing Act was established. All priority use claims were subject to a process of validation and constituted a primary permit preference limitation.
- Base property production: a minimum base property requirement, which was based on either land or water, was imposed in all BLM-administered districts. In this process, assets such as private base property, hay fields, haystacks, pastures, and water rights were inventoried; private water flows were measured; and the production calculated. To meet this factor and avoid reductions in the grazing permit, the existing grazing allocation must not have exceeded the maximum allowable base property production ratio.
- Public land carrying capacity: the adjudication period included a one-point-in-time carrying capacity survey of all grazing allotments. The permit was subject to reduction if, after meeting the above factors, the allocations exceeded the surveyed carrying capacity. However, no there were no AUM reductions if the carrying capacity met the permitted numbers.

Together, these three factors determine the total of adjudicated grazing privileges (Resource Concepts, Inc. 2001). Adjudicated grazing permits, which were referred to as base property qualifications subject to change with further information, included the number of AUMs suspended historically (those AUMs above the number of adjudicated AUMs grazed historically on BLM-administered lands).

Following the adjudication process, grazing management systems were developed and incorporated into AMPs as BLM grazing management was implemented (Resource Concepts, Inc. 2001). Typically, grazing permits were adjusted again as AMPs were implemented. This management continued from the mid-1960s until the Natural Resources Defense Council lawsuit pushed management toward EIS development in the mid-1970s.

Generally, BLM Soil-Vegetation Inventory Method surveys in EISs were the basis for AUM reductions during this period; however, objections to this method from the range livestock industry and professional range management specialists led to a reevaluation and eventual discontinuation of this method (Resource Concepts, Inc. 2001). Reevaluation of this method determined that one-point-in-time surveys could not be used to accurately and consistently calculate range carrying capacity. Following the discontinuation of Soil-Vegetation Inventory Method surveys, a program of use and vegetation trend monitoring was established, which uses monitoring data to evaluate the effectiveness of grazing practices in meeting RMP, rangeland program summary, and AMP objectives.

To prioritize range management funds, allotments were classified as I (Improve Current Condition), M (Maintain Satisfactory Conditions), and C (Manage Custodially to Protect Existing Resources) based on resource potential, complexity of resource issues, and current management status (Resource Concepts, Inc. 2001).

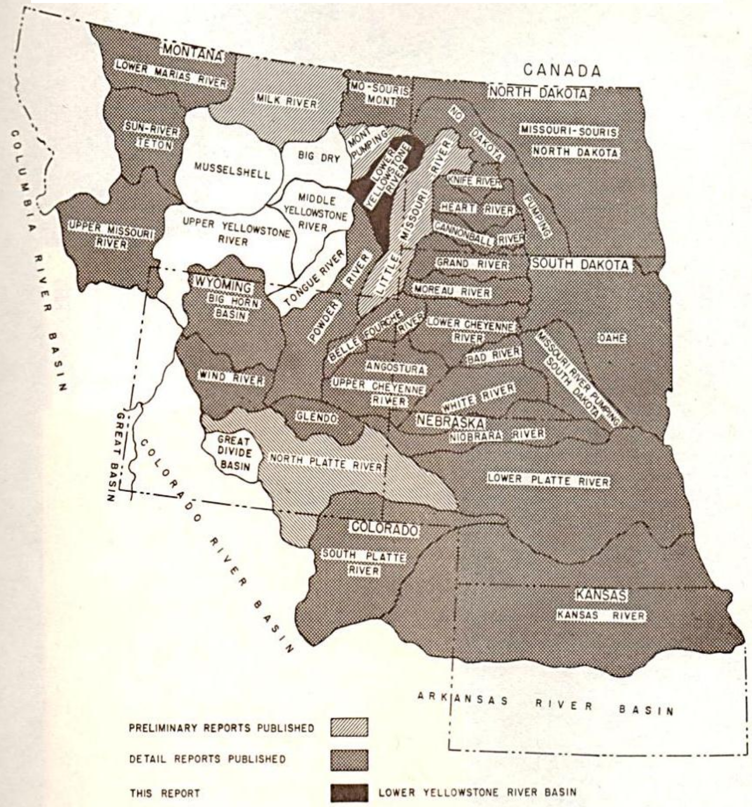
Management Era (1980 to Present)

BLM WO 1986 IM 1986-706 instructed that all I and M allotments be monitored and evaluated (as 5-year monitoring data became available), the result of which would be grazing agreements, grazing decisions, or documentation for the allotment file (Resource Concepts, Inc. 2001). Vegetation condition and trends are important components of these evaluations, which provide data for range specialists about the impacts of current livestock use, wild horse use, precipitation, wildfire, and other factors to vegetation and provide management recommendations. Changes in management, such as reductions in livestock numbers, changes in season of use, or other changes in grazing management (such as implementation of a grazing system), were implemented through agreement or decision.

From 1956 through 1972, the BLM conducted a classification of public lands within the MCFO (Figure 3-16) typically referred to as the Missouri River Basin Surveys. From this effort, eight separate reports were generated, which provided the grazing use by AUMs for all BLM-administered lands at the time of the surveys.

The process to estimate the available forage for livestock grazing was conducted by trained individuals and involved intensive vegetation sampling (clipping, weighing, and ocular estimation). The BLM, in cooperation with grazing advisory boards, used the information to adjust the AUMs allocated to a grazing permit. This cooperative effort resulted in decreases, increases, or no changes being implemented for every grazing permit in the field office. These changes were implemented in a timely manner and completed prior to 1975.

FIGURE 3-16. HISTORICAL BUREAU OF LAND MANAGEMENT STUDIES IN THE MISSOURI RIVER BASIN (LAND CLASSIFICATION)



Source: BLM 1958

The MCFO has consisted of two separate resource areas, which eventually became planning areas: the Big Dry planning area and the Powder River planning area. Actions concerning levels of grazing allocation in these areas differed through time.

For the Big Dry resource/planning area (1.18 million acres of BLM-administered lands), the BLM completed the *Big Dry Vegetation Allocation EIS* in 1983. The ROD for this EIS (*Big Dry Area Rangeland Program Summary*, December 1982) further refined grazing allocations and provided that the allocation of vegetation would be 25 percent to livestock and 75 percent to other uses (e.g., wildlife, soil protection, and other uses). The ROD was implemented and grazing permits were adjusted if necessary. These allocations were confirmed in the 1996 *Record of Decision and Approved Big Dry Resource Area Management Plan*.

The BLM completed the RMP ROD for the Powder River resource/planning area (1.32 million acres of BLM-administered lands) in 1985. This ROD mimicked the actions in the Big Dry planning area and specified that the allocation of vegetation would be 25 percent to livestock and 75 percent to other uses (wildlife and watershed protection). The ROD was implemented and is reflected in the 1986 *Rangeland Program Summary for the Powder River Resource Area*.

Since 1986, monitoring data (vegetative and levels of use) has been the basis for increasing or decreasing permitted use. Through this process, the MCFO has successfully changed the grazing allocations on allotments to ensure that healthy ecological systems are provided for future generations.

In the early 1980s, the BLM established three categories for allotments to identify areas where management was potentially needed and to prioritize workloads and the use of range improvement dollars. Allotments were categorized as Improve Existing Resource Conditions (I), Maintain Existing Resource Conditions (M), or Custodial Management (C). When allotments in the planning area were originally categorized, resource conditions in some of the allotments placed in the I category were not necessarily in need of improvement. Criteria used to place allotments in the I category included the amount of public land present in the allotment; willingness of permittee to invest in management; opportunities for constructing range improvements; existence of grazing related resource conflicts; allotments with moderate to high forage production potential and production at low to moderate levels; the rancher’s or BLM’s identification of opportunities for improvement in range condition; static or downward range trends; livestock management's potential improvement through water distribution; seasons of use or other factors; and opportunities for a positive economic return on public investments.

Use of the allotment categorization to prioritize work subsided when Standards for Rangeland Health and Guidelines for Livestock Grazing Management were implemented in 1997. The BLM IM No. 2009-018 has revived use of the allotment categorization and directed offices to use it to prioritize work associated with processing and issuing grazing authorizations (BLM 2008g). Criteria to assign allotment categorization has evolved to ensure land health considerations are the primary basis for monitoring the effectiveness of grazing management and for prioritizing the processing of grazing permits and leases. The MCFO has reviewed allotment categories and will continue to review to determine an allotment's appropriate category. Current categorizations include 918 Custodial (C) allotments, 654 Maintain (M) allotments, and 204 Improve (I) allotments.

There are 156 allotments operating under an AMP. Of these, 80 are I category allotments, 68 are M category allotments, and 8 are C category allotments (BLM 2007f). These AMPs describe grazing activities designed to meet specific resource objectives and become part of the terms and conditions of a grazing permit or lease.

RANGELAND HEALTH

In 1997, the Montana BLM State Director approved the *Montana/Dakotas Standards for Rangeland Health and Guidelines for Livestock Grazing Management* (BLM 1997c). The MCFO Standards are described below.

- Standard 1: Uplands are in PFC.
- Standard 2: Riparian areas and wetlands are in PFC.
- Standard 3: Water quality meets Montana State standards.
- Standard 4: Air quality meets Montana State standards.
- Standard 5: Habitats are provided for healthy, productive, and diverse native plant and animal populations and communities. Habitats are improved or maintained for special status species (federally threatened, endangered, candidates for this status, or Montana species of special concern).

Guidelines for grazing management are preferred or advisable approaches to grazing management practices, and are provided to maintain or improve resource conditions in upland and riparian habitats available to livestock grazing.

Assessments of Standards for Rangeland Health include evaluations of rangeland conditions through the comparison of existing conditions to the parameters for sites according to NRCS Ecological Site Descriptions. Assessments include the soil and vegetation characteristics and impacts of management on native species conditions, including sage-grouse. Ecological Site Descriptions include considerations for vegetation structure, composition, and habitat characteristics that would be expected for specific sites based on soils and precipitation.

If Standards for Rangeland Health are not met and livestock grazing determined to be the causal factor, regulation directs the authorized officer to implement actions (e.g., permit modifications, range improvement projects) prior to the next grazing season that will move the allotment towards meeting the Standards for Rangeland Health (43 CFR 4180). Permit modifications include changing season of use, changing type of livestock, addressing carrying capacity, directing salt and mineral placement. Range improvement projects include both structural and nonstructural types. Examples of structural improvements include fences and water developments, and examples of nonstructural improvements include prescribed fire or seedings. Range improvement projects are not only used to improve livestock grazing management, but also to improve watershed conditions and enhance wildlife habitat. The design of range improvement projects addresses wildlife habitat needs in the project-planning process. The MCFO has completed the assessment of all of its allotments in relation to the Standards for Rangeland Health. Actions have been implemented in the 41 allotments (2 percent) determined to be failing one or more of the Standards for Rangeland Health.

RANGELAND MONITORING

The BLM conducts rangeland monitoring to determine compliance with Standards for Rangeland Health (or progress toward these standards) or AMP objectives. If monitoring indicates that progress is occurring, or standards and objectives are being met, management continues. However, if progress is not shown, management adjustments are made. Adjustments are made by agreement or decision through consultation, cooperation, and coordination with permittees and the interested public in accordance with legislation, regulation, and policy.

During periods of drought, monitoring is used to assess allotment conditions. The BLM's 2004 *Policy for Administering Public Land Grazing in Montana, North and South Dakota During Periods of Drought* describes how efforts will first be directed toward allotments with resource concerns, such as sage grouse habitat.

Climate change effects to grazing are addressed during allotment monitoring and inspections for land health standards in coordination with the grazing permit renewal process.

MINERALS

GEOLOGIC RESOURCES

The planning area is located along the eastern portion of Montana within the western part of the Great Plains Geologic Province. The Great Plains Province extends from the Dakotas into the eastern portions of Montana, Colorado, and Wyoming. The sedimentary basins within the Great Plains Province have accumulated sediments several miles in thickness; these sandstones, shale, limestones, and coals provide reservoirs for Montana's fossil energy resources of oil, natural gas, coal, and CBNG (ALL 2001b).

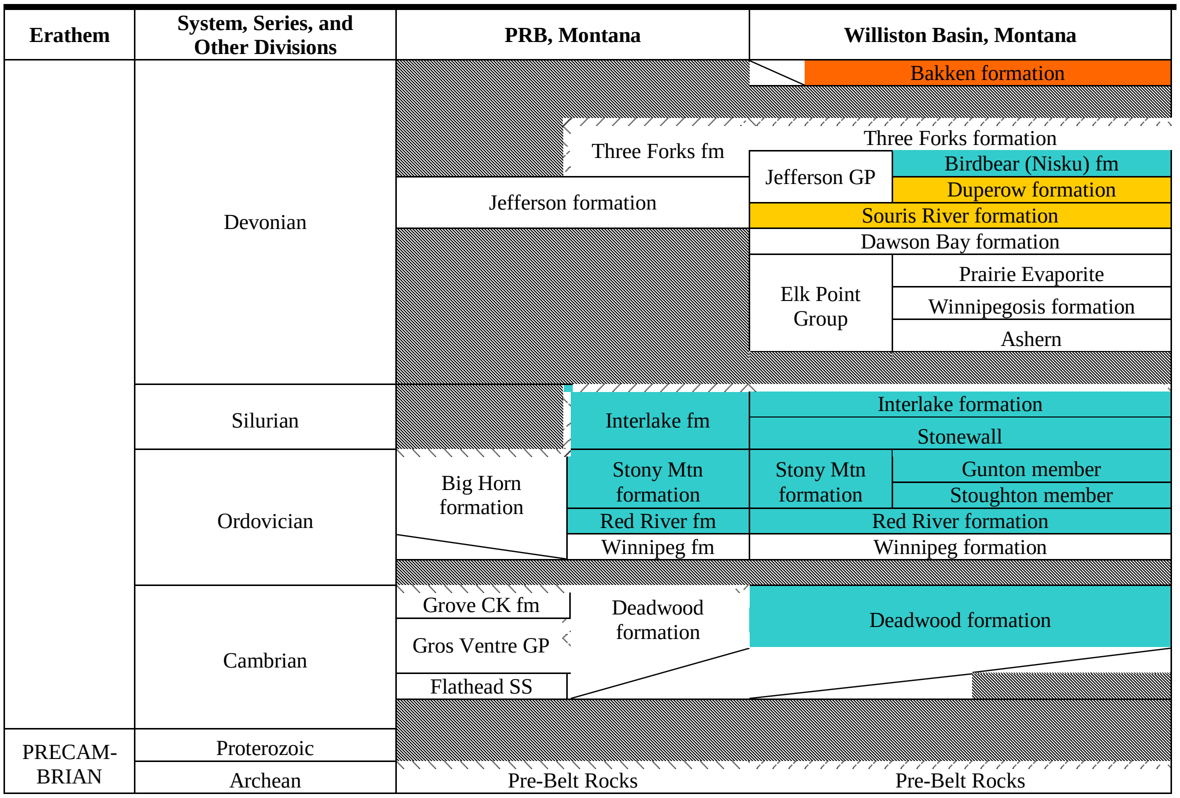
The two most important geologic structural features in the planning area are the Williston and Powder River (PRB) basins (Figure 3-17 and Map 68). The PRB is bound to the west by the Bighorn Uplift, to the southwest and south by the Casper arch, Laramie Mountains, and Hartville Uplift, and to the east by the Black Hills Uplift. The Miles City Arch and Cedar Creek Anticline are structural features that occur within the planning area and that separate the PRB from the Williston Basin. The Williston Basin is bound on the east and southeast by the Canadian Shield and Sioux uplifts, to the west and southwest by the Black Hills Uplift, Miles City Arch, and Porcupine and Bowdoin domes (J.A. Peterson 1996).

Cultural sign at Glendive Short Pine Off-highway Vehicle Use Area in Dawson County

FIGURE 3-17.
STRATIGRAPHIC COLUMN OF THE PLANNING AREA PORTIONS OF THE POWDER RIVER AND WILLISTON BASINS

Erathem	System, Series, and Other Divisions		PRB, Montana	Williston Basin, Montana
CENOZOIC	Quaternary		Alluvium	Alluvium
CENOZOIC	Tertiary	Pliocene		Flaxville formation
CENOZOIC	Tertiary	Miocene		
CENOZOIC	Tertiary	Oligocene		
CENOZOIC	Tertiary	Eocene	Wasatch formation	
CENOZOIC	Tertiary	Paleocene	Fort Union fm	Tongue River member
CENOZOIC	Tertiary	Paleocene		Lebo shale member
CENOZOIC	Tertiary	Paleocene		Tullock member
MESOZOIC	Cretaceous	Upper	Hell Creek formation	Hell Creek formation
MESOZOIC	Cretaceous	Upper	Montana Group: Fox Hills formation	Montana Group: Fox Hills formation (Pierre formation)
MESOZOIC	Cretaceous	Upper	Montana Group: Bearpaw shale	Montana Group: Bearpaw shale (Pierre formation)
MESOZOIC	Cretaceous	Upper	Montana Group: Judith River formation (Parkman SS)	Montana Group: Judith River formation (Pierre formation)
MESOZOIC	Cretaceous	Upper	Montana Group: Clagget formation	Montana Group: Clagget formation (Pierre formation)
MESOZOIC	Cretaceous	Upper	Montana Group: Eagle formation (Shannon SS)	Montana Group: Eagle formation (Pierre formation)
MESOZOIC	Cretaceous	Upper	Montana Group: Telegraph Ck. fm.	Montana Group: Telegraph Ck. fm.
MESOZOIC	Cretaceous	Upper	Colorado Group: Niobrara formation	Colorado Group: Niobrara formation 1st White SPK
MESOZOIC	Cretaceous	Upper	Colorado Group: Carlile formation	Colorado Group: Carlile formation
MESOZOIC	Cretaceous	Upper	Colorado Group: Greenhorn formation	Colorado Group: Greenhorn formation
MESOZOIC	Cretaceous	Upper	Colorado Group: Belle Fourche fm	Colorado Group: Belle Fourche fm
MESOZOIC	Cretaceous	Lower	Colorado Group: Mowry formation	Colorado Group: Mowry formation
MESOZOIC	Cretaceous	Lower	Colorado Group: Muddy SS	Colorado Group: Muddy SS
MESOZOIC	Cretaceous	Lower	Colorado Group: Skull Creek SH	Colorado Group: Skull Creek SH
MESOZOIC	Cretaceous	Lower	Colorado Group: Dakota Silt	Colorado Group: Dakota Silt
MESOZOIC	Cretaceous	Lower	Dakota formation	Dakota formation
MESOZOIC	Cretaceous	Lower	Fusion formation	Kootenai formation (Fusion)
MESOZOIC	Cretaceous	Lower	Lakota formation	Lakota formation
MESOZOIC	Jurassic		Morrison formation	Morrison formation
MESOZOIC	Jurassic		Sundance formation: Upper Mbr	Ellis Group: Swift formation
MESOZOIC	Jurassic		Sundance formation: Lower Mbr	Ellis Group: Rierdon formation
MESOZOIC	Jurassic			Ellis Group: Piper fm: Bowes Mbr
MESOZOIC	Jurassic			Ellis Group: Piper fm: Firemoon Mbr
MESOZOIC	Jurassic			Ellis Group: Piper fm: Tampico Mbr
MESOZOIC	Jurassic		Gypsum Springs fm	Ellis Group: Nesson fm: Kline Mbr
MESOZOIC	Jurassic			Ellis Group: Nesson fm: Picard Mbr
MESOZOIC	Jurassic			Ellis Group: Nesson fm: Poe Mbr
MESOZOIC	Triassic		Spearfish formation	Spearfish formation; Pine Salt
PALEOZOIC	Permian		Phosphoria fm; Minnekahta fm	Minnekahta formation
PALEOZOIC	Permian		Phosphoria fm; Opeche fm	Opeche formation
PALEOZOIC	Pennsylvanian		Tensleep fm; Minnelusa fm	Minnelusa formation
PALEOZOIC	Pennsylvanian		Amsden formation	Tyler formation
PALEOZOIC	Mississippian			Heath formation
PALEOZOIC	Mississippian			Otter formation
PALEOZOIC	Mississippian			Kibbey formation
PALEOZOIC	Mississippian		Madison LS	Madison GP: Charles formation
PALEOZOIC	Mississippian		Madison LS	Madison GP: Mission Canyon LS
PALEOZOIC	Mississippian		Madison LS	Madison GP: Lodgepole LS

FIGURE 3-17.
STRATIGRAPHIC COLUMN OF THE PLANNING AREA PORTIONS OF THE POWDER RIVER AND WILLISTON BASINS



Powder River Basin

The PRB covers about 12,000 square miles, with the smaller portion in Montana (Ellis et al. 1999). The PRB formed through Laramide tectonics that uplifted the area to the west and, subsequently, these uplifted areas contributed sediments to the basin during the Late Cretaceous and Early Tertiary periods. The PRB is asymmetrical in shape with the strata dipping toward the basin axis, which trends northwest to southeast and is located near the western basin margin (Ellis, Stricker, Flores, and Bader 1998). The strata dip away from the surrounding topographic highs of the Bighorn Uplift to the west, the Casper Arch, Laramie Mountains, and Hartville Uplift to the southwest and south, and the Black Hills Uplift to the east. Along the western side of the basin, the strata have steep dips, averaging between 20 and 25 degrees. Along the eastern side of the basin, the dips are much shallower, ranging from 2 to 5 degrees (Ellis et al. 1998).

Outcrops within the PRB consist primarily of Tertiary rocks from the Paleocene Fort Union and Eocene Wasatch formations. However, within the PRB portion of the planning area, rocks of the Fort Union formation are more numerous. The Fort Union formation is divided into three members (in descending order), the Tongue River, Lebo, and Tullock members. The formation consists of interbedded sandstones, siltstones, mudstones, carbonaceous shale, and coals. Numerous coal beds occur in the Fort Union formation and are of sub-bituminous rank. The Tongue River member contains the most important, minable coal beds in the Fort Union formation (Sholes and Daniel 1992). The coal beds are more laterally extensive and thicker within this interval. These coal beds are being mined and are the source of the CBNG near the western boundary of the planning area. The Tongue River member varies in thickness between 750 feet near the outcrop, to over 3,000 feet near the axis of the PRB (Roberts et al. 1999a; Roberts et al. 1999b). One of the coal beds mined in the southern portion of Big Horn County was over 80 feet in thickness. In addition to the Tertiary rocks, deeper Cretaceous strata, including the Judith River formation, Eagle and Muddy sandstones, and the Dakota and Lakota formations, are overlain by Bearpaw shale and are present across the PRB at depths ranging from 2,000 to 9,000 feet (Noble et al. 1982).

Cretaceous rocks also outcrop in the planning area. This occurs primarily along the Missouri River, in the areas of the Poplar and Porcupine domes, along the Cedar Creek Anticline, and in the southeast portion of the planning area where the Black Hills Uplift has influenced the strata. The oldest Cretaceous unit that outcrops in the planning area is the Mowry formation, which occurs in the extreme southeast portion of the planning area.

Williston Basin

The Williston Basin is the other important geologic structural feature in the planning area. The Williston Basin is a nearly circular basin with the center located near Williston, North Dakota. The Williston Basin encompasses approximately 300,000 square miles extending into South Dakota and the Canadian provinces of Saskatchewan and Manitoba. At its deepest point, sediments are believed to be as much as 16,000 feet thick, with the strata becoming shallower and thinner toward the margins. It is believed that initial basin subsidence occurred during the Late Cambrian to Early Ordovician periods. Two prominent structural features, the Cedar Creek Anticline and the Poplar Dome, occur in the Montana portion of the Williston Basin (Heck, LeFever, Fischer, and LeFever 2002).

The sedimentary rocks within the Williston Basin are unique because the basin contains one of the most complete rock records observed, with sedimentary rocks from the Cambrian through the Holocene periods (Schmoker 1996; Heck et al. 2002). Outcrops within the planning area of the Williston Basin consist primarily of Tertiary sediments from the Fort Union formation. This formation consists of sandstones, siltstones, mudstones, limestones, carbonaceous shale, and coals (Flores 1992). Sandstone is the most common rock type and limestone is the least common. The coal beds are mainly lignite in rank. Within the planning area, the Fort Union formation contains economic coals that are laterally extensive. Although CBNG has not been produced from coals within the Williston Basin, a small surface mining operation is located in the eastern portion of the planning area.

Geologic Hazards

Geologic hazards within eastern Montana consist primarily of threats from earthquakes but even these events are rare. Most strong earthquakes in Montana have occurred in the western third of the state. The only significant earthquake outside this area was a magnitude 6 event that occurred on June 24, 1943, within the planning area, in the southern portion of Sheridan County. A well-constructed granary located at Froid, Montana, was so severely damaged that wheat spilled out, and cracked plaster and minor chimney damage were reported at the towns of Homestead, Redstone, and Reserve, Montana (USGS 1974).

MINERALS

As described in the *Geologic Resources* section, minerals of commercial value occur throughout the planning area. Private entities, state governments, or the federal government own or administer mineral ownership, like surface administration or ownership (Map 69). The following discussion relates to leasable minerals (coal, oil and gas, phosphate, asphalt, sulfur, potassium, and sodium), locatable minerals (gold, silver, bentonite, uranium, and other metals), and mineral materials (sand, gravel, building stone, pumice, and clay) administered by the federal government.

Leasable Minerals

Coal

There are approximately 10,924,000 BLM-administered coal acres in the planning area. Currently, five surface mines (Absaloka, Decker, Rosebud, Savage, and Spring Creek) produce coal in the planning area (Maps 70 through 74). The inactive Big Sky Mine is also located in this area and currently undergoing final reclamation. Four of the mines (Absaloka, Decker, Rosebud, and Spring Creek) mine coal beds within the Tongue River member of the Fort Union formation and are located in the Montana portion of the PRB. This area contains large coal deposits, much of which is administered by the federal government. The coal is sub-bituminous in rank. Extensive CBNG resources are being developed in the southwestern portion of the planning area. Some of the coal mined in the planning area is exported out of state and the remainder of the coal is burned at mine-mouth located power plants. A small amount of coal is trucked in state to power plants and manufacturing facilities.

The Absaloka Mine, located in Big Horn County, operates entirely on Indian coal leases. The coal is owned by the United States in trust for the Crow Indian Tribe. The BLM does not administer the coal leases but does provide review and approval authority for certain aspects of the mine plan and inspection for production verification to ensure maximum economic recovery of coal for the benefit of the Crow Tribe. The coal screening process and BLM planning efforts do not apply to Indian trust coal lands.

The Savage Mine is a small surface operation located near Sidney, Montana, and is the only mine within the Montana portion of the Williston Basin. The coal (lignite in rank) is trucked to a local power plant and sugar beet processing facility.

In 2006, total production from the five mines located in the planning area was about 41.49 million tons. These operations encompass approximately 48,790 acres (Montana Coal Council 2007). Of the 15 major coal resource states, Montana ranks first, with a resource base of approximately 120 billion tons, with 100 billion tons located within the Montana portion of the PRB. The federal government administers the majority of this coal, but only approximately 1.2 billion tons are considered recoverable, according to the DOE-EIA (DOE-EIA 2006). See Map 75 for coal development potential in the planning area.

The Powder River RMP focused primarily on the management of federal coal resources. The principal factor considered for coal resource development during land use planning is the identification that states coal areas are acceptable for further consideration, which includes coal leasing as defined by 43 CFR 3420.1 4(e):

> "The major land use planning decision concerning the coal resource shall be the identification of areas acceptable for further consideration for leasing which shall be identified by the screening procedures listed below."

Four coal screens must be applied as described below.

- Identification of Coal with Development Potential: Areas could be eliminated from further consideration if they do not contain coal with development potential.
- Surface Owner Consultation: Negative surface owner views could cause lands to be eliminated from further consideration.
- Application of Unsuitability Criteria: Areas can be eliminated if determined to be unsuitable for surface mining based upon application of a list of 20 unsuitability criteria.
- Multiple Use Conflict Analysis: Additional areas of coal resource may be eliminated from consideration based on multiple use considerations if other federal resource values are determined to be superior to the coal resource.

The Powder River RMP Task Force applied these coal screens to the new areas composing the recently modified planning area boundary because some coal areas were previously screened in previous management framework plan efforts. Coal areas identified during previous RMP planning efforts include 68.4 billion tons of federal coal designated with developmental potential, 4.62 billion tons of coal eliminated from consideration because of negative surface owner viewpoints, 4.76 billion tons eliminated because of application of the unsuitability criteria, and 4.51 billion tons eliminated because of multiple surface-use conflicts, for a total of 54.37 billion tons of coal available for leasing.

In the Big Dry RMP area, coal resource totals 19.28 billion tons, of which 47.5 percent (or 9.16 billion tons), are federal minerals. Coal is subject to individual tract analysis and lease-by-application rules (43 CFR 3420.1, BLM Manual H-3420-1). Any party desiring a coal lease can apply and the application would be considered based on its own merits. The coal planning process is described in the *Coal* section of the *Minerals Appendix*.

Oil and Gas

Oil and gas development has been underway in the planning area since the early 20th century and is currently focused in two exploration and production areas, the Williston Basin (which includes the Cedar Creek Anticline, Poplar Dome, Williston Basin northeast, and all remaining areas within the basin) and the PRB. There are approximately 5.8 million acres of BLM-administered oil and gas mineral estate in the planning area and the RFD identified areas with high, medium, low, and very low development potential. Based on this analysis, approximately 49 percent of the BLM-administered oil and gas minerals were considered to have high development potential, approximately 31 percent considered to have medium development potential, and 20 percent considered to have low development potential (Map 5). The BLM offers multiple oil and gas lease sales per year (Table 3-30).

MBOGC compiles well completion data and APDs for wells drilled in Montana. Well data for the planning area was extracted from the database to define the number of registered APDs and the number of producing wells (MBOGC 2010). The well and field data define three currently active areas: the PRB, Williston Basin, and Porcupine Dome.

Areas with a high development potential occur within the PRB, Cedar Creek Anticline, and Williston Basin (northeastern Montana) (see the RFD in the *Minerals Appendix*). The PRB contains CBNG within the Lower Tertiary Fort Union formation, while in the Cedar Creek Anticline and the northeastern Williston basin areas, oil and gas resources occur in various formations (from the Cambrian Deadwood through the Upper Cretaceous Eagle formations). The northeast Williston Basin and Cedar Creek Anticline areas are the two of the most active oil- and gas-producing regions in Montana and recent CBNG development has made the PRB one of the largest natural-gas-producing regions in Montana.

TABLE 3-30.
OIL AND GAS LEASE SALES FOR THE MILES CITY FIELD OFFICE (2005 TO 2009)

Sale Date (Calendar Year)	Parcels Offered	Parcels Sold	Acres Offered	Acres Sold	Total Bonus	Average Bonus per Acre
2005	183	66	124,994	39,464	$556,306.75	$14.10
2006	107	74	96,671	68,975	$761,115.50	$11.03
2007	339	149	521,153	159,742	$977,897.00	$6.12
2008	36	25	12,383	12,383	$707,759.50	$57.16
2009	60	59	38,297	37,537	$786,366.75	$20.95
Total	**725**	**373**	**793,498**	**318,101**	**$3,789,445.50**	**$11.91**
Average Annual	**145**	**75**	**158,700**	**63,620**	**$757,889.10**	**$11.91**

As of October 2011, the State of Montana indicated that there were 3,733 producing wells, 1,086 shut in wells, 614 active injection wells, and 317 temporarily abandoned wells in the planning area. Seventy-seven percent, or 2,896, of these wells are located within the Williston Basin geologic area; this includes 1,634 producing wells from the Cedar Creek Anticline. The PRB contained 642 producing oil and gas wells.

In 2006, natural gas and oil prices were over $7 per one thousand standard cubic feet of gas and $50 per barrel, respectively; both values were considerably higher than previous projections. The United States Department of Energy's Energy Information Administration (DOE-EIA) had predicted a decrease in the price of these commodities over the next 10 years. If this occurs, it would likely result in slightly slower development rates than if the current price trends continue. The January 8 to January 14, 2010 issue of the Rocky Mountain Oil Journal listed the Williston Basin sweet crude oil price at $64.50 per barrel and Opal, Wyoming, gas pricing as $5.84 per thousand cubic feet. The 2010 DOE-EIA *Energy Outlook* projects both crude oil and natural gas prices to increase in the future. This would result in the rate of development predicted in the RFD.

Proposed Carter Master Leasing Plan

In accordance with WO guidance (BLM 2010j), a master leasing plan (MLP) area has been proposed for a portion of Carter County. The area is approximately 393,000 acres in size, containing 139,000 acres of BLM-administered surface; 229,000 acres of private land; and 25,000 acres of state land. The BLM administers approximately 282,500 acres of oil and gas with 3,678 acres currently leased. This area is within the PRB and contains both high potential and low potential for oil and gas development. Figures for wells that could be drilled and produced in the MLP area are included in the PRB numbers.

MLPs expand the tools available to the BLM to address resource conflicts prior to leasing and present finer-scale analysis for identified smaller areas than the entire RMP planning area. It can help to control the amount and kind of surface uses based upon current condition and identified conflicts between resource values and leasing.

Resources found in the proposed MLP area include sage-grouse habitat and leks, raptor nests, a great blue heron rookery, big game crucial winter range, sensitive soils, riparian areas, major streams, uranium paleontological localities and cultural resource sites. For further discussion about cultural resources in the area, see the Cultural Resources section of this chapter. For further discussion regard wildlife in the area, see the Wildlife section of this chapter. The Little Missouri River borders the southeast corner and Boxelder Creek runs through the northwest corner of the MLP. Major ROWs included in the MLP Area include Montana Highway 323 and United States Highway 212.

Sage-grouse habitat (139,000 acres) in the area is currently managed uniformly across the proposed MLP Area. Wind speeds in the area indicate a good potential for generating wind power. The Finger Buttes ACEC, designated for its scenic quality, is also found within the proposed MLP area. The area is currently managed according to VRM Class II (480 acres), VRM Class III (10,000 acres), and VRM Class IV (130,000 acres) objectives.

Decker Area

The Decker area, located in the southwestern corner of the planning area, is managed under the BLM's 2003 *Record of Decision for the Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans*, which was supplemented by the 2008 *Record of Decision for the Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings RMPs*. See the *Minerals Appendix* for more information about management of CBNG in this area. For monitoring in this area, see the Wildlife Monitoring and Protection Plan in the *Fish and Wildlife Appendix*.

Geothermal

Geothermal energy is heat energy contained in the rocks of the earth's crust. Certain geologic conditions and processes resulted in shallow geothermal resources that underlie substantial portions of many western states, including land administered by the MCFO. As of 2010, there was a low level of interest in developing Montana's federally owned geothermal resources.

These shallow resources can be classified as low temperature (less than 194^{o} F), moderate temperature (194^{o} F to 302^{o} F), and high temperature (greater than 302^{o} F). Low and moderate temperature resources are generally used for heating, rather than power generation. Binary steam plants can now generate power with fluid between 225^{o} and 360^{o} F.

There is limited geothermal energy potential within the planning area because it is far removed from active volcanic or tectonic activity. Within the planning area, known resources, discovered during the course of oil and gas exploration, are limited to warm and hot water occurring in Paleozoic carbonates and warm water occurring in Cretaceous sandstones. One documented use of geothermal energy has occurred southeast of Ashland, Montana, where several "dry" oil and gas wells were converted to provide warm water for stock (Sonderegger and Bergantino 1981). The BLM has only received two inquiries since 1979 regarding the development of federal geothermal resources in Montana (BLM 2004f).

Locatable Minerals

Locatable minerals are those minerals for which a mining claim can be staked. There is very low potential for locatable minerals such as gold, chromium, titanium, zeolite, and associated minerals such as copper, lead, and zinc in the planning area and high potential for bentonite and uranium.

The Mining Law of 1872 (30 U.S.C. 22 et seq.) provides for the exploration, discovery, and mining of metallic and certain non-metallic minerals on federal lands. Any U.S. citizen or corporation organized under state laws can locate mining claims. A mining claim is located on federally administrated minerals that potentially contain deposits of locatable minerals.

Exploration and mining activity on most BLM-administered lands are subject to the regulations found in 43 CFR 3809. These regulations require that a notice be filed for all cases when an exploration proposal would disturb less than 5 acres. For exploration operations disturbing more than 5 acres of mining operations, a plan of operations (PO) is required. They further require the operator to prevent the unnecessary and undue degradation of the land, complete full reclamation of any disturbance, and provide a financial guaranty sufficient to cover 100 percent of the cost of reclamation. There is no requirement to file a notice for casual use activity.

Mining activities that disturb more than 5 acres requires the submittal of a PO that includes a mining and reclamation plan as well as a description of all essential measures to prevent the unnecessary and undue degradation of the land. The BLM also requires a financial guaranty of 100 percent of the estimated cost to reclaim the disturbed area. The completion of a NEPA analysis that includes an opportunity for public comment on the mining proposal, is also required as part of the evaluation process.

Bentonite

Bentonite clay is the predominate major locatable mineral in the planning area, occurring in the Cretaceous Belle Fourche and Mowry formations in the southeast corner of the planning area within the PRB. These deposits, located in southern Carter County near the town of Alzada, have been extensively mined by two companies. Bentonite also occurs in other Cretaceous rocks, such as the Hell Creek formation and Bearpaw shale. Bentonite is exposed along the Missouri River as far downstream as Brockton on the Fort Peck Indian Reservation, and along the axis of the Cedar Creek Anticline from Baker to Glendive.

Because limited exposures restrict the data available regarding the quantity and quantity of bentonite, an accurate determination of bentonite development potential in the planning area is difficult to make. However, since there are two active bentonite-mining operations in southern Carter County, future development of this resource in the planning area is anticipated to continue (Map 76).

Uranium

Uranium mineralization has been documented in sandstones composing the Lower Cretaceous Fall River and Lakota formations in the planning area within southern Carter County. From the 1970s through the late 1980s, mining and energy companies completed thousands of reconnaissance and closely spaced delineation drill holes.

Compilation and analysis of these data indicate the potential to expand existing mineralized areas. Meetings with state regulators have been conducted with the intention of permitting several of these projects for continued exploration and development. At this time, the exploration activity is being conducted on private land, where BLM has no management authority but some uranium mineralization on BLM-administered land in this area is anticipated and exploration proposals could be forthcoming.

It is too early to determine if the uranium deposits that occur in the planning area will be developed but, if continued exploration efforts result in the identification of sufficient minable reserves, it is anticipated that development of this resource may occur. Previous testing from the 1970s and 1980s indicates that conditions are favorable for in situ uranium recovery. This mining method would result in a smaller environmental footprint when compared to traditional mining methods (Map 77).

Gold

In the 1930s, gold placer mining occurred in the Yellowstone River as far downstream as Miles City, but there is no record of the quantity produced. Because gold is rare and extremely fine-grained, gold mining is considered a recreational activity in the planning area.

Mineral Materials

Federal mineral materials consist of sand and gravel used for road surfacing and construction projects These mineral materials are dispensed in the best interest of the public while providing for reclamation of mined lands and preventing unnecessary degradation of non-mineral resources. Mineral materials occurring within the planning area consist primarily of clinker, sand, and gravel (with small amounts of petrified wood, agate, and building stone). Mineral materials occurring on public land are reserved to the government and the land patented under the Stock Raising Homestead Act (30 U.S.C. 54 and 43 U.S.C. 299).

Because there are minimal gravel deposits and scoria in the planning area, clinker or scoria is commonly used in place of gravel for road-surfacing material. Clinker is reddish to black colored, heat-hardened rock formed by the burning of coal beds that thermally alter the overlying strata. Within the Fort Union formation, clinker covers approximately 1,500 square miles in the planning area and commonly caps ridges to form higher topographic landscapes. Approximately 50 to 90 billion cubic yards of clinker are present in the planning area. Coal mines located in the western portion of the planning area use clinker for surfacing haul roads and construction pads for structures and equipment.

Sand and gravel deposits occur in the major river valleys and cap terraces that are adjacent to and overlying some rivers. Sand and gravel terraces commonly occur approximately 300 feet above the Yellowstone River. Southwest of Forsyth, these deposits cap ridges up to 1,000 feet above the Yellowstone River. Smaller terrace deposits consisting of coarse quartz sand occur along Little Beaver Creek, north of Ekalaka. Several firms mine sand and gravel for road and construction projects in this area.

In the future, clinker, sand, and gravel will continue to be used for road surfacing and construction projects, while additional coal and CBNG development may increase the use of clinker. As long as the clinker remains within the boundary of the lease and is used for lease development, no charge is assessed for clinker removed in the process of extracting coal from under a federal lease. As mentioned above, mineral materials are reserved to the government on public lands and lands patented under the Stock Raising Homestead Act. Within the planning area, there are numerous active pits for mineral materials. The number and location of these pits are related by the number and location of ongoing construction projects. With the increase in oil and gas drilling in the planning area, the demand for scoria use in access road and drill pad construction has increased. Mineral materials may be obtained under a free use permit issued by federal, state, or local government agencies but the permit can only be sold to individuals or corporations. Limited amounts of petrified wood and agate may be collected for casual use without charge.

RECREATION

Recreation is a part of most lifestyles and an important element in overall quality of life. Lands within the planning area offer a diverse array of recreational activities and provide broad spectrum of recreational experience opportunities (Map 48). Recreational opportunities are available to the public on all BLM-administered lands with legal access. Recreation activities available within the planning area include hunting, wildlife viewing, driving for pleasure, fishing, picnicking, camping, hiking, OHV use, rock collecting, mountain biking, floating, horseback riding, photography, and snowmobiling. However, the most intensive, area-wide recreational use occurs during the big game hunting season. The majority of BLM-administered lands in the planning area contain populations of big game, at least seasonally, that attract hunters from throughout the state and entire country. Fishing opportunities include fishery reservoirs offering trout and bass and winter months provide opportunities for ice fishing. To a limited extent, public lands have access to the Yellowstone and Missouri rivers where catfish, walleye, sauger, sturgeon, pike, and bass are available.

RECREATION MANAGEMENT AREAS

The recreation management areas are classified as either special recreation management areas (SMRA) or extensive recreation management area (ERMA). The recreation management areas are land units in which Recreation and Visitor Services objectives are recognized as a primary resource management consideration and specific management is required to protect the recreation opportunities. The recreation management area designation is based on recreation demand and issues, recreation setting characteristics, resolving use or user conflicts, compatibility with other resource uses, and resource protection needs. The BLM will use Recreation Setting Characteristics classifications to manage for a variety of recreation opportunities, including degree of development (see the *Recreation Appendix* for these classifications). All BLM-administered public lands are classified in one of three Recreation Management Area categories, as described below.

- SRMAs are administrative units where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance or distinctiveness, particularly in comparison to other areas used for recreation. Management focus is to protect and enhance a targeted set of activities, experiences, benefits, and desired recreation setting characteristics. Recreation and Visitor Services management is recognized as the predominant land use planning focus.
- The ERMAs are administrative units that require specific management consideration in order to address recreation use, demand, or Recreation and Visitor Services program investments. Management focus for ERMAs is to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA.
- Public Lands Not Designated as Recreation Management Areas are all lands not designated as a SRMA or an ERMA. Management focus is to meet basic Recreation and Visitor Services and resource stewardship needs for these areas.

Special Recreation Management Areas

The MCFO has identified three SRMAs in the planning area to direct recreation program priorities toward areas with high resource values, elevated public concern, or significant amounts of recreational activities. The three areas currently managed as SRMAs include the Powder River Depot, Calypso, and Lewis and Clark Trail. Summaries of SRMAs in the planning area follow.

Powder River Depot SRMA

The Powder River Depot SRMA is located approximately 6 miles southwest of Terry, Montana, and contains approximately 162 acres and 2 miles of river frontage along the Yellowstone and Powder rivers (Map 78). The SRMA includes a portion of the Lewis and Clark National Trail as well as views of Sheridan Butte and the Terry Badlands WSA. The area is also located within a portion of the Powder River Depot ACEC. The SRMA is popular for dispersed recreation, particularly fishing. Other recreational uses include rock collecting, driving for pleasure, wildlife viewing, hunting, photography, and camping. Historians have additional interest in the location because the area is within a cultural complex rich with early history. There are two-track roads leading to noticeable, primitive campsites in the area.

Calypso SRMA

The Calypso SRMA is approximately 71 acres and located next to the Terry Badlands WSA and along the Yellowstone River (Map 78). The SRMA includes a portion of the Lewis and Clark National Trail and is a popular fishing, camping, picnicking, hiking, sightseeing, and wildlife-viewing area. Dispersed recreation occurs within this SRMA, including primitive camping opportunities.

Lewis and Clark Trail SRMA

The Lewis and Clark Trail SRMA is a corridor that encompasses a portion of the Missouri and Yellowstone rivers and totaling about 16,350 acres of BLM-administered land (Map 49). This SRMA includes the Lewis and Clark National Historic Trail, a developed recreation site, and dispersed use sites along the river shoreline. Primary recreation opportunities include fishing, camping, power boating, river floating, swimming, hiking, hunting, and wildlife viewing. See the *Special Designation Area* section for more information about the Lewis and Clark Trail.

Other Areas

In areas in which recreation resources receive heavy use, developed recreation sites are often constructed or planned for to aid in managing impacts. Other areas of high interest to recreational users that are not currently SRMAs include:

- Big Sky Back Country Byway (Map 48),
- Dean S. Reservoir (Map 79),
- Glendive Short Pine OHV Area (Map 27),
- Hay Draw TMA (Map 80),
- Knowlton TMA (Map 81),
- Howrey Island (Map 82),
- Matthews Recreation Area (Map 83),
- Moorhead Recreation Area (Map 84),
- Pumpkin Creek Ranch and Recreation Area (Map 85),
- Strawberry Hill Recreation Area (Map 86), and
- Terry OHV Area (Map 28).

Proposed Special Recreation Management Areas

Proposed SRMAs include Dean S. Reservoir, Glendive Short Pine OHV Area, Howrey Island, Matthews Recreation Area, Moorhead Recreation Area, Pumpkin Creek Ranch and Recreation Area, and the Terry OHV Area. The three existing SRMAs will continue to be managed as such. Descriptions of proposed SRMAs follow.

Dean S. Reservoir

Dean S. Reservoir is located approximately 11 miles east of Miles City, Montana. This proposed SRMA includes fire pits and picnic tables enclosed within a fenced reservoir. In the past, the reservoir has been stocked with fish, including trout and bass. During low water years or drought years, the reservoir is not deep enough to sustain a fish population. Primary recreation opportunities include fishing, camping, wildlife viewing, short hikes, photography, sledding, and ice skating.

Glendive Short Pine OHV Area

The Glendive Short Pines OHV Area is an open OHV area on approximately 2,800 acres of BLM-administered land. The area is located approximately 6 miles south of Glendive, Montana. The Lewis and Clark National Historic Trail and Lewis and Clark SRMA are very close to the northwest boundary of the OHV Area. A vault toilet, OHV loading ramp, and kiosk are located within the site. Primary recreation opportunities include OHV use, hunting, camping, and snowmobiling along with some dispersed use such as occasional rock collection and hiking.

Howrey Island

Howrey Island is located approximately 6 miles southwest of Hysham, Montana, on approximately 600 acres of BLM-administered land. The Lewis and Clark National Historic Trail and the Lewis and Clark SRMA are within the boundary of Howrey Island. The area includes a boat ramp, parking area, vault toilet, American-Disabilities-Act-compliant concrete trail and picnic tables, fire pits, and benches along the trail. Primary recreation activities include water-related activities such as fishing and boating, wildlife viewing, hiking, camping, hunting, biking, bird watching, and photography.

Matthews Recreation Area

Matthews Recreation Area is located approximately 9 miles northeast of Miles City, Montana, on approximately 90 acres of BLM-administered land. The Lewis and Clark National Historic Trail and the Lewis and Clark SRMA are within the boundary of Matthews Recreation Area. Amenities at the site include a ramada, American Disabilities Act-compliant fishing platform, vault toilet, and campground host area and picnic tables, fire pits, and fire grills. Primary recreation activities include fishing, camping, and hiking. Hunting is allowed with a shotgun or bow and arrow.

Moorhead Recreation Area

The Moorhead Recreation Area is located approximately 30 miles southwest of Broadus, Montana, and about 4 miles north of the Wyoming border. The campground is on approximately 15 acres of BLM-administered land. The area includes a vault toilet and picnic tables and fire rings. Concrete foundations, remnants of a historical dam project that was never completed, are located on a hill above the campground. Primary recreation activities include camping, picnicking, and hiking. The campground receives heavy use during hunting season.

Pumpkin Creek Ranch and Recreation Area

Pumpkin Creek Ranch and Recreation Area is located approximately 18 miles south of Miles City, Montana. There are several access points to this approximately 21,000 acres of BLM-administered land. The lands were part of a land exchange completed in 2010. There are no amenities at the site. Primary recreation activities include hunting, hiking, mountain biking, wildlife viewing, sledding, snowmobiling, and horseback riding.

Strawberry Hill Recreation Area

Strawberry Hill Recreation Area is located 8 miles east of Miles City, Montana, on approximately 4,200 acres of BLM-administered land. The entrance to the recreation area is on state land, which contains a ROW for public access. The area includes a parking area, and primary recreation activities include hiking, mountain biking, horseback riding, and picnicking. During the winter, popular activities include snowshoeing, sledding, and snowmobiling.

Terry OHV Area

The Terry OHV Area is located approximately 2 miles north of Terry, Montana, on approximately 100 acres of BLM-administered land. The area is a designated open OHV area. The Lewis and Clark SRMA is near the southern boundary of the OHV area. Primary recreation activities include OHV use and some hunting.

The remainder of the planning area (those areas not managed as SRMAs or national back country byways) can also be managed as ERMAs and open to dispersed recreational use with minimal regulatory constraints. Recreational activities within the ERMA generally occur in combination with other resource activities. The

BLM management within ERMAs is generally limited to custodial actions to prevent conflicts between resource uses and provide for the health and safety of the public and the health of the lands.

RECREATION USE

The Recreation Management Information System estimates participation of recreational activities recorded at BLM-administered sites and areas. Estimates are based on observations and professional judgment because there are no fee sites to record registration within the planning area. Visitation rates are estimated by numbers of participants and visitor days. Participants are the actual number of people who take part in a recreational activity. A visitor day is a common unit of measure of recreation used among federal agencies and one visitor day represents an aggregate of 12 visitor hours at a site or area. (It should be noted that the number of participants and the number of visitors might differ because one visitor can participate in several recreational activities and recorded as a participant several times.) Increases or decreases in visitation to some areas may result from gas prices; drought cycle influences on water levels in waterbodies, streams, or rivers; or other influences that affect local tourism. Reported recreation-related visitor use days over the last 5 years in the planning area are estimated at over 506,731 visits. Adjustments made in 2009 to account for underreported dispersed use across the planning area more narrowly estimate visitor use at over 106,000 visits annually. Estimation protocols and technologies to inventory visitor days continue to evolve.

The highest participation by activity include hunting, wildlife viewing, driving for pleasure, fishing, picnicking, camping, target practice, and hiking. Hunting had the most visitor days out of the top 10 recreation activities in the planning area, with approximately 136,692 participants spending more than 59,583 visitor days in 2009 alone. Approximately 82,466 participants viewed wildlife for more than 12,069 visitor days, while approximately 8,678 participants spent more than 2,165 days fishing and 9,099 participants used 11,580 visitor days for camping.

Popular activities within developed recreation sites vary for each site. For example, OHV use at the Glendive Short Pine OHV area averages approximately 2,000 participants and 1,000 visitor days annually, Knowlton and Hay Draw TMAs are very popular for dispersed big game hunting and camping, and Matthews and Howrey Island are popular for fishing, day use, and camping.

SPECIAL RECREATION PERMITS

The MCFO administers special recreation permits to manage organized commercial and noncommercial recreation activities. Special recreation permits are issued to accommodate six categories of recreational use, as follows: commercial, competitive, vending, individual or group use in special areas, organized group activity, and event use. Lengths of permits depend on the activities proposed, areas in question, and the past record of the potential permittee. Permits may be issued for periods of up to 10 years but are for day use only.

The MCFO manages approximately 50 special recreation permits each year, and the primary activity for these permits is big game hunting. Most hunting outfitter or guides pursue mule deer, white-tailed deer, pronghorn, elk, and upland birds. Currently, there are no hunting camps existing within the planning area.

Special recreation permits are also issued for OHV group riding events, paleontological events, trail runs, horseback riding, and trail rides. All existing permits have been issued on a first-come, first-served basis. Fee collecting for these special recreation permits are used to offset administrative costs, monitor approved activities, and protect recreation resource values for future use.

Trends

The current trends in recreational use in the planning area indicate a steady increase. Many of the recreational activities are directly tied to various natural resources and correlation between the condition of the resources and the number of users. The recreation trends tied most directly to resource conditions are those that require healthy wildlife populations. These include hunting and fishing recreation trends. Annual precipitation will affect the level of rivers, reservoirs, and streams and related recreation, such as fishing and floating. Given favorable conditions for these resources, their recreational use will likely continue to rise.

Tourism is an important component of Montana's economy, creating a significant demand for outdoor recreation facilities. State and regional tourism marketing efforts are directed at attracting higher value, lower impact non-resident visitors to maximize tourism revenues while minimizing the tourism's effect on Montanans. Since demand for both motorized and non-motorized recreation access will likely continue to increase, facilities will be needed to effectively meet this demand and simultaneously manage Montana's natural and cultural assets in a sustainable manner. The rising public demand for recreational opportunities will likely increase the complexity of managing dispersed recreation.

RENEWABLE ENERGY

Renewable energy includes solar power, wind, biomass, and geothermal resources (see the *Forestry* section for biomass and the *Minerals* section for geothermal leasing). As demand for clean and viable energy to power the nation has increased, consideration of renewable energy sources available on public lands has come to the forefront of land management planning. No special management provisions were considered in the Powder River and Big Dry RMPs specifically concerning renewable energy resources (BLM 1985c and 1996). Applications for renewable energy ROWs for wind and solar projects would be analyzed on a case-by-case basis, although there has been no demand for these projects on public lands in the planning area to date.

In cooperation with the National Renewable Energy Laboratory (NREL), the BLM assessed renewable energy resources on public lands in the western United States (BLM and NREL 2003). The assessment reviewed the potential for concentrated solar power, photovoltaic, wind, biomass, and geothermal on BLM-, Bureau of Indian Affairs (BIA)-, and USFS-administered lands in the west. Hydropower was not addressed in the BLM and NREL report. The BLM and NREL report did not identify the MCFO as one of the top 25 BLM planning units with the highest potential for any kind of renewable energy but the MCFO was rated as favorable for wind power with a high potential for renewable power.

In June 2005, the BLM also prepared a *Wind Energy Development Programmatic Environmental Impact Statement* (PEIS) to evaluate issues associated with wind energy development on western public lands administered by the BLM. The PEIS established policies and best management practices (BMPs) for the administration of wind energy development activities and minimum requirements for mitigation measures for wind projects on BLM-administered lands. Analyses conducted in this PEIS support the amendment of specific land use plans where potentially developable wind resources are located. The plan covers an 11-state study area and identifies BLM RMPs that should be amended under this PEIS; however, this RMP and the previous RMPs managed by the MCFO (the Powder River and Big Dry RMPs) are not mentioned in the PEIS because this RMP revision addresses this issue directly. Proposed amendments include adoption of the proposed programmatic policies and BMPs as well as identification of specific areas where wind energy development would not be allowed. WO IM No. 2009-043 (BLM 2008e) updates and clarifies the policies and BMPs provided in this PEIS. BLM's Washington IM 2010-077 also provides guidance for wind energy cases.

The DOE's Office of Energy Efficiency and Renewable Energy and the BLM are currently preparing a PEIS to evaluate utility-scale solar energy development, amend relevant BLM land use plans in consideration of establishment of a new BLM solar energy development program, and develop and implement agency-specific programs. These programs would facilitate environmentally responsible utility-scale solar energy development by establishing environmental policies and mitigation strategies related to solar energy development in six western states (Arizona, California, Colorado, New Mexico, Nevada, and Utah). The study area has been limited to these six states because they encompass the most prospective solar energy resources suitable for utility-scale development over the next 20 years. Current BLM guidance to facilitate the processing of ROW applications for solar energy projects on public lands can be found in the BLM's WO IM No. 2007-097, 2009-013 (2008), 2010-077, 2010-141, and 2011-003 (2010).

WIND RESOURCES

The American Wind Energy Association ranks Montana fifth in the nation for wind-energy potential (AWEA 2010). As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). In general, at 50 meters, wind power Class 4 or higher can be useful for generating wind power with large turbines. Class 4 and above are considered to have high potential for development based on 50-meter mapping, although some Class 3 areas may have increased potential for development based on higher wind speeds at 80-meter heights. Possible high wind shear could cause higher wind power class values at 80 meters than those shown on the 50-meter map in particular locations in the Class 3 areas. This map indicates that the planning area has wind resources consistent with utility-scale production. Approximately 548,000 acres of BLM administered land within the planning area are rated at a Level 4 (Good) or above for wind potential. Table 3-31 displays the acres in the planning area by their wind potential, Classes 1 through 7. Map 87 identifies the wind potential of BLM-administered surface in the planning area, Classes 1 through 7, based on 50-meter data, by low (Classes 1 and 2), moderate (Class 3), and high potential (Classes 4 through 7).

Since the completion of the Big Dry and Powder River RMPs, there have been no wind energy generation facilities authorized on BLM-administered lands within the planning area. Although there have been a few inquiries about the possibility of erecting wind turbines sites on BLM-administered lands, no applications have been submitted and subsequently no authorizations have occurred.

Montana Dakota Utility's Diamond Willow Wind Farm near Baker, Montana, is the only known existing (there are no known proposed) utility-scale wind project within the planning area (Montana Department of Commerce 2010b). It is not located on BLM-administered lands. This facility, which was completed in 2008, includes 13 turbines and a total capacity of 19.5 megawatts (additional turbines may be added to this site in the future). However, smaller proposals (less than 10 towers) may be encountered in the near future because of incentives offered to municipalities for such development. Despite this current low level of interest in wind energy, it is possible that with improvements in technology and a more favorable economic climate, interest in the development of wind energy facilities on public lands will increase.

TABLE 3-31.
WIND POTENTIAL IN THE PLANNING AREA

Wind Power Class and Resource Potential	BLM-administered Acres in the Planning Area and Percentage of Planning Area (%)	BLM-administered Acres of Wind Potential and Percentage of Planning Area (%)	Total Acres in the Planning Area and Percentage of Planning Area (%)	Total Acres of Wind Potential and Percentage of Planning Area (%)
Class 1: Poor	68,333 (2)	602,520 (22)(Low)	877,738 (3)	6,769,529 (26) (Low)
Class 2: Marginal	534,187 (19)		5,891,791 (23)	
Class 3: Fair	1,608,731 (58)	1,608,731 (58) (Moderate)	14,964,377 (58)	14,964,377 (58) (Moderate)
Class 4: Good	528,868 (19)	547,904 (20)(High)	4,004,091 (15)	4,110,287 (16) (High)
Class 5: Excellent	18,335 (<1)		102,638 (<1)	
Class 6: Outstanding	701 (<1)		3,558 (<1)	
Class 7: Superb	0 (0)		0 (0)	

SOLAR RESOURCES

Utility-scale solar energy facilities are facilities that can generate large amounts of electricity for direct input to the electricity transmission grid. Solar energy technologies potentially suitable for use in utility-scale applications include concentrating solar power technologies and photovoltaic technologies.

Concentrating solar power plants generate electric power by using mirrors to concentrate (focus) the sun's energy and convert it into high-temperature heat, which is then channeled through a conventional generator. The plants consist of two parts: one that collects solar energy and converts it to heat and another that converts the heat energy to electricity. The BLM and NREL study (2003) did not identify any BLM-administered lands within the planning area with a high potential for this type of energy source and indicated that the potential for this type of renewable energy lies primarily in states to the south and southwest of Montana. In keeping with this assessment, the MCFO has not had any expressions of interest in developing concentrating solar power facilities on public lands.

Photovoltaic technologies convert the sun's radiant energy directly to electricity. Photovoltaic technologies use solar panels to capture light energy from the sun and then use that light energy to drive an electric current. The BLM and NREL study (2003) did not identify the MCFO as one of the top 25 BLM planning areas for photovoltaic potential. The MCFO has not authorized any photovoltaic facilities strictly for commercial power production, nor has interest been expressed by industry in developing such facilities on BLM-administered lands in the planning area. Since the completion of the Big Dry and Powder River RMPs, there have been no solar energy facilities authorized on BLM-administered lands within the planning area. There are no known existing or proposed utility-scale solar projects within the planning area (Montana Department of Commerce 2010b).

Localized, small-scale solar projects utilizing photovoltaic panels to power livestock wells occur in the planning area, but are developed under specific resource program provisions rather than authorized via a ROW grant.

TRANSPORTATION

This section describes transportation (roads, primitive roads, trails, bridges, and culverts), maintenance, and construction. Travel route availability decisions (Open, Closed, or Limited) are determined through site-specific travel management plans as discussed under the *OHV* section. Types and usage of recreation and communication sites are discussed under *Recreation* and *Lands and Realty.*

ROADS AND TRAILS

Transportation system roads provide physical access to public, state, private, and other federal lands throughout the planning area. Demands for the existing transportation network are directly related to the resources and uses found on the public lands. The transportation system provides access for commercial activities (e.g., livestock grazing, timber harvest, minerals development, outfitting and guiding), non-commercial activities and casual use (e.g., OHV use, hunting, fishing, firewood gathering, recreational driving), and administrative access to manage resources.

In compliance with BLM’s Roads and Trails Terminology, Technical Note 422 (BLM 2006c), the transportation system represents the sum of the BLM’s recognized inventory of linear features (roads, primitive roads, and trails). The terms roads, primitive roads, and trails describe specific categories of transportation linear features and represent subsets of the BLM’s transportation system (Table 3-32).

The BLM uses facilities asset management as the system for the management of all BLM transportation system assets. In this context, the term “assets” refers to linear features that have been formally identified (or designated) as BLM assets. The planning area has approximately 8,361 lane miles of BLM-administered system roads, and 514 lane miles of these are recorded in facilities asset management. However, this information will change as travel plans are completed

Maintenance intensities provide guidance for appropriate standards of care to recognized routes within the BLM and provide consistent objectives and standards for the care and maintenance of BLM routes according to identified management objectives. Maintenance intensities provide operational guidance to field personnel on the appropriate intensity, frequency, and type of maintenance activities that should be undertaken to keep the route in acceptable condition and provide guidance for the minimum standards of care for annual route maintenance (see the Travel and Maintenance Appendix for more information regarding maintenance intensities).

The maintenance intensities have not yet been determined for the facilities asset management roads. The BLM anticipates the roads will be identified as Level 1 or Level 3. Level 1 roads are typically two-track roads that receive minimal maintenance. Level 3 roads are used more frequently than Level 1 roads and may access or connect larger blocks of public land or are important for recreational and commercial access. These roads do receive some level of maintenance that is generally intended to keep the route open for the majority of the year.

TABLE 3-32.
TRANSPORTATION LINEAR FEATURE DEFINITIONS

Road	A linear route declared a road by the owner, managed for use by low-clearance vehicles having four or more wheels, and maintained for regular and continuous use.
Primitive Road	A linear route managed for use by four-wheel drive or high-clearance vehicles. Primitive roads do not normally meet any BLM road design standards.
Trail	A linear route managed for human-powered, stock, or OHV forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Almost all of the roads are single lane and all Level 1 roads are natural material. Level 3 roads have a variation of natural material to some aggregate. A few high usage roads are double lane (greater than 15 feet in width). Culverts and cattle guards on the roads are constructed and maintained as part of the transportation system.

Beginning in fiscal year 2007, Comprehensive Condition Assessments of Bureau roads are performed on a 10-year cycle and inspected after events (such as severe storms) to determine emergency actions or priority maintenance needs. These roads do not include roads that fall within the boundaries of administrative and recreation sites. Roads within these boundaries are assessed during the recreation or administrative site assessments, which are used to assist in the identification and prioritization of maintenance needs.

An average of 100 to 120 lane miles of BLM-administered road is maintained annually by the MCFO. The MCFO also maintains 4 miles of trails. While the maintenance intensities are identified for roads, funding often does not allow the BLM to meet the maintenance provisions of the assigned levels.

TRAVEL MANAGEMENT AND OHV USE

Travel management and OHV use BLM regulations that require that all BLM-administered lands be designated as Open, Limited, or Closed to OHVs (43 CFR 8342.1). As part of the travel management planning process, the designation will change from limited to existing roads, primitive roads, and trails to limited to designated roads, primitive roads, and trails upon the completion of a travel management plan. Public expectations and demand for motorized and non-motorized recreation has changed substantially. Advances in motorized and non-motorized recreation travel technology and use have increased the public’s ability to traverse conditions and terrains not previously predicted. As a result, there is increased conflict between motorized and non-motorized users. Public interest and demand for motorized and non-motorized travel opportunities are expected to continue to increase. Travel management will continue to be addressed at the site-specific planning level. The vast majority of OHV use throughout the planning area is limited to existing roads and trails.

TRAVEL MANAGEMENT PLANS

Areas within the planning area with existing travel plans include the Knowlton and Hay Draw Travel Management Areas (TMAs). Brief descriptions of these areas follow.

The Knowlton TMA is located approximately 40 air miles east of Miles City, in portions of Custer and Fallon counties (Map 81). The area encompasses approximately 40,000 acres of BLM-administered land with approximately 17,000 acres with legal public access. The proposal was developed using a community-based decision making process facilitated by the Eastern Montana Resource Advisory Council. The objectives of the plan are to increase wildlife security through a reduction in motorized vehicle impacts, reduce motorized vehicle impacts to non-motorized users, and provide some allowance for motorized, on-road big game retrieval to assist hunters in retrieving downed big game animals.

The Hay Draw TMA is located in Carter County, approximately 21 air miles east of Broadus, Montana (Map 80). The project area encompasses approximately 19,300 acres of BLM-administered lands and approximately 12,840 acres of school trust land. The objectives of the plan are to provide motorized access within a reasonable distance of hunting opportunities on BLM-administered land and maintain the integrity of the crucial mule deer and pronghorn winter range habitat.

LEVEL AND TRENDS OF OHV USE

Increased OHV use has emerged as a significant issue in the planning area because of concerns related to potential resource degradation due to high levels of OHV use. General estimates of OHV use in the planning area can be assumed through review of the estimates prepared for Montana public lands as part of the Final Off-highway Vehicle Environmental Impact Statement and Proposed Plan Amendment for Montana, North Dakota, and Portions of South Dakota (BLM and USFS 2001). This report estimated that the number of trucks used in off-highway applications increased 12 percent between 1990 and 1998, while ATVs and motorcycles (considered a separate group in this report) increased by 61 percent (Table 3-33).

Furthermore, recreational use projections indicate that OHV use could reach 24,597 ATVs and motorcycles and 33,727 trucks by 2005. By 2015, these numbers are projected to increase to 36,249 ATVs and motorcycles and 36,797 trucks (BLM and USFS 2001). The above data suggest that OHV use is one of the fastest growing activities in Montana. With the registration of OHVs increasing on an annual basis, it is expected that OHV use will continue to increase throughout all public lands in Montana, including the planning area.

TYPE OF OHV USE

OHV use is a popular method to explore public lands, and it provides access for non-motorized recreational purposes, such as fishing, hiking, mountain biking, horseback riding, and primitive camping opportunities. Motorized OHV use in the planning area consists primarily of riding and driving ATVs, motorcycles, and full-sized trucks and vehicles for pleasure. Participation in these recreational activities varies by season, topography, vegetative cover, and number of people taking part in the activity. Public lands in the planning area provide many opportunities for OHV use, varying from backcountry to concentrated-use areas.

Non-recreational OHV use of the planning area includes agricultural management, energy development, and land-management activities. Employees of government agencies, ranchers, energy companies, and utility providers are permitted users who utilize OHVs to access and maintain the infrastructure required for the continued operation and maintenance of their facilities.

**TABLE 3-33.
ESTIMATED NUMBER OF VEHICLES
USED OFF-HIGHWAY IN MONTANA (1990 TO 1998)**

Year	Trucks	ATVs and Motorcycles	Total
1990	24,162	7,399	**31,561**
1991	23,930	8,404	**32,334**
1992	24,706	10,020	**34,726**
1993	26,193	11,729	**37,922**
1994	26,584	13,165	**39,749**
1995	26,919	14,072	**40,991**
1996	26,941	15,352	**42,293**
1997	27,308	16,898	**44,206**
1998	27,423	18,953	**46,376**

Source: BLM and USFS 2001

Snowmobile use also occurs within the planning area and snowmobile use is mostly unrestricted on BLM-administered lands within the planning area when snow cover is adequate. However, snowmobiles are not considered OHVs as defined in the *Final Off-highway Vehicle Environmental Impact Statement and Proposed Plan Amendment for Montana, North Dakota, and Portions of South Dakota* (BLM and USFS 2001) because they are usually driven on a layer of snow and their environmental effects are different from those of motorized, wheeled OHVs.

OFF-HIGHWAY VEHICLE ACCESS

Existing roads and trails, some of which are user created, provide access to the general areas where most recreation activities take place on public lands in the planning area. Roads and trails already lead to most site-specific recreation spots, such as dispersed camping and picnicking sites, water-related access sites, shooting areas, and viewing areas but the public land ownership pattern in the planning area (and Montana) is highly fragmented, which results in access difficulties and potential conflict. Conflicts over access can take place wherever fragmented ownership occurs (such as along waterways) or wherever prime resource values occur and recreation or other user demands are high. Even where access exists, the lack of boundary markers and adequate maps often contributes to confusion about access and can result in conflicts among the public, public land administrators, and owners of associated or intermingled private lands.

REASONABLY FORESEEABLE FUTURE USE

Demand for access to public lands is expected to increase while public access to private lands is expected to decrease over time, and a number of factors, including public awareness, increased tourism, and increased restrictions by private landowners, are responsible for this trend. Federal, state, and local agency marketing efforts to increase tourism are expected to increase visitation. With an increase in non-local users, demand for commercially guided activities (such as hunting, fishing, and sightseeing) will increase. However, demand is expected to increase much faster than the BLM’s ability to acquire new access. Continued private acquisition and fencing is expected to decrease land availability and limit access, causing local users’ demands on public land to increase. OHV use will continue into the future; however, the general lack of understanding of land use ethics have increased inappropriate uses of OHVs on federal lands and represent management challenges for the BLM.

LANDS AND REALTY

Lands and realty involves issues of land disposal, acquisition, use, ROW corridors, withdrawals, and transportation systems. Although FLPMA directed the BLM to retain public lands, lands and realty issues arise regularly, often accompanying other resources or resource concerns. This section addresses each of these areas as they apply to the planning area.

LANDS AND REALTY OWNERSHIP PATTERNS

The MCFO administers approximately 2.8 million surface acres and 11.0 million subsurface acres of mineral estate in eastern Montana. (See Table 1-1 in Chapter 1 for more information.) The 17-county planning area consists of more than 25 million surface acres and includes all of Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Treasure, and Wibaux counties and portions of Big Horn and Valley counties. Miles City is the largest community in the planning area. Other cities in the planning area include Wolf Point, Plentywood, Glendive, Sidney, Colstrip, Terry, Jordan, Circle, Broadus, Ekalaka, Alzada, Culbertson, Forsyth, Lame Deer, and Baker.

A complex history of homestead and railroad land grants has caused generally fragmented surface and subsurface mineral ownership. Lands containing all federally owned minerals are either public domain or lands in which the surface area was patented under the Stock Raising Homestead Act of 1916 (BLM 1984 and 1995). Ownership or administration of surface and subsurface lands also extends to other federal, state, tribal, or private interests in the planning area. These agencies include the Fort Peck Tribe, the Bureau of Reclamation

(BOR), USFS, USFWS, BIA, Crow Tribe, Northern Cheyenne Tribe, and the State of Montana as well as local counties and private entities within the planning area. The USDA administers the lands containing the Fort Keogh Livestock and Range Research Laboratory, which is located southwest of Miles City.

Primary Land Uses

The primary uses of public lands in the planning area include livestock ranching; recreation; and major oil, gas, and coal development. The latter industrial developments occur primarily in Fallon, Richland, Roosevelt, Dawson, Wibaux, Big Horn, Rosebud, and Sheridan counties. Other land uses in the planning area includes wildlife habitat and recreation (BLM 1984 and 1995). Notable areas reserved for wildlife habitat include the Charles M. Russell National Wildlife Refuge, Medicine Lake National Wildlife Refuge, Lamesteer National Wildlife Refuge, Fox Lake Wildlife Management Area, and game management areas within the planning area. The principle recreation areas occur primarily in the Custer National Forest (at the southern boundary of the planning area) and along the Yellowstone, Powder, Tongue, Missouri, and Little Missouri rivers. These areas offer a variety of dispersed recreational opportunities.

Rights-of-Way

ROWs across public lands are generally granted under Title V of FLPMA and Section 28 of the Mineral Leasing Act (43 CFR 2800 and 2880 and 30 U.S.C. 181 et seq.) or pursuant to U.S.C. Title 23, Section 317 for highways under the Federal Aid Highway Act of 1958 (August 27, 1958, as amended). In areas in which ROWs are allowed, stipulations from the BLM Handbook 2801-1 are used to protect resource values.

The planning area contains various types of federally authorized ROWs, which typically include uses for utility and transportation purposes, communication sites, water-related facilities (such as ditches, canals, dikes, wells, reservoirs, and water pipelines), associated facilities, and oil and gas pipelines. There are approximately 919 authorized ROWs on BLM-administered lands within the planning area, affecting 84,314 acres of federal surface. Of these authorized ROWs, 282 (affecting 2,840 acres) are subject to rental payments. On average, 25 ROWs are issued each year; however, more were issued in recent years than in past years.

The 1996 Big Dry RMP identifies ROW avoidance areas that include cultural and wildlife ACECs, Makoshika State Park (lands since patented to MFWP), and SRMAs. The Smoky Butte ACEC was designated a ROW exclusion area

(BLM 1996). In past planning efforts, fragmented federal ownership pattern in the planning area caused ROW corridors to be considered but not carried forward. Applicants are encouraged to locate new facilities within existing ROWs (BLM 1985c and 1996).

Communication Sites

Nine existing sites have communication site plans in place and these plans are updated, as needed, if additional uses are authorized (Table 3-34). There are two other small communication sites without site plans authorized in the planning area, as described below.

- The Smoky Butte ACEC site, which may have a plan developed on it in the future with a television repeater station (T. 18N, R. 36E, Section 12, NWSW); and
- the Larsen Ranch mobile two-way radio site (T. 11N, R. 52E, Section 19, Lot 2), in which a plan is not needed and will not be developed.

Unauthorized Uses

Unauthorized land uses also occur in the planning area (BLM 1985c, 1996, 2010g). These unauthorized uses generally include agriculture, occupancy, exclosures, abandonment of property or trash, and ROWs. For these types of unauthorized uses, most of the cases are small, agricultural trespasses that are fewer than 10 acres in size.

Other unauthorized uses relating to occupancy include abandoned structures (e.g., mobile homes) or agricultural structures (e.g., barns). Unauthorized exclosures typically consist of fences used to protect sources of water or other natural resource features installed on public lands without prior approval. Unauthorized ROW trespasses consist of utility and transportation uses, communication sites, oil and gas pipelines, roads, and water-related facilities installed on public lands without proper approval.

TABLE 3-34.
COMMUNICATION SITES WITH PLANS IN THE PLANNING AREA

Communication Site	Legal Location[1] (Principal Meridian Montana)	Number of Facilities	Type of Site and Use
Alzada	T. 8S, R. 57E, Sec. 10, SENE	2	Government only, low power non-broadcast uses
Fallon	T. 14N, R. 52E, Sec. 32, SW	1	Non-broadcast, two-way, cellular, and microwave uses
Flowing Well	T. 18N, R. 43E, Sec. 8, NE	2	Non-broadcast, two-way radio, cellular, and microwave uses
Fort Peck	T. 26N, R. 42E, Sec. 9, NE	1	Non-broadcast cellular and microwave uses
Locate	T. 8N, R. 53E, Sec. 27, NW	1	Low power non-broadcast uses
Lookout Butte	T. 6N, R. 60E, Sec. 4, NESW	1	Low power broadcast translator uses
Rosebud Buttes	T. 5N, R. 42E, Sec. 24, NE	2	Full power broadcast and other low-power non-broadcast and low-power broadcast uses
Sheep Mountain	T. 15N, R. 47E, Sec. 24, NW	2	Government only non-broadcast two-way radio uses
McGuire Creek	T. 21N, R. 43E, Sec. 13, NW	1	Low power, non-broadcast, cellular, and two-way radio

[1]These legal descriptions do not delineate the boundaries of the right-of-way use areas, but give approximate locations. Boundaries of the use areas are defined in individual site plans.

ROADWAYS

The planning area also includes several major roads and highways that provide access to public lands. Examples of major highways include Interstate 94, which crosses through the center of the planning area as well as a variety of state highways. For example, State Highways 2, 13, 16, 24, and 201 traverse the northern segment of the planning area, while State Highways 22, 200, 12, 39, 59, 323, and 212 are located in the central and southern segments of the planning area. The State of Montana, local counties, BLM, USFS, and private individuals and corporations maintain roads and highways in the planning area.

Land Use Authorizations

Leases and permits, authorized under Section 302 of FLPMA for various land uses, are spread throughout the planning area. Two Section 302 leases have been issued to coal companies for land use related to coal mining. Fifteen Section 302 permits are authorized in the planning area, with eight for agricultural uses (farming) and the rest for various uses (including a shop, a garage, a shed, gravel storage, a monitoring well, and environmental monitoring and coal mine reclamation). Short-term permits are issued for filming purposes. All of these leases and permits are subject to rental payments. The USFS issued eight permits on Bankhead-Jones lands prior to those lands entering under BLM's administration. These permits are for two roads, two pipelines, a barn and granary, a telephone line, a reservoir, and stock water storage. Only one of these permits was subject to rental payments (which were paid in full) while the other seven were not (BLM 2010g).

The Recreation and Public Purposes Act (R&PP) of June 14, 1926 (43 U.S.C. 869 et seq.), as amended, authorizes the lease of public lands for recreational or public purposes to state and local governments and to qualified non-profit organizations. There are no current R&PP leases authorized within the planning area (BLM 2010g).

Land Tenure (Including Access)

Land tenure (or land ownership) adjustment refers to those actions resulting in the disposal of BLM-administered land or the acquisition of nonfederal lands or interests. In the planning area, these actions have normally included sales (offered on the initiative of the BLM often in response to public requests), exchanges, transfers, direct purchases, and withdrawals. See Map 41 for land pattern adjustment and access information. (The lands are identified by map as allowed for during land use planning as stated in the H-1601-1 Land Use Planning Handbook, Appendix C, page 20, E. Lands and Realty Number 1, and not by legal description.) The planning area has a scattered land pattern of approximately 4,536 tracts of federal BLM-administered land in 1,194 townships and 40,780 sections.

For sales to occur, the tract of public land, which must be identified through land use planning, must meet one or more of the following disposal criteria (Section 203(a) of FLPMA) described below.

- It is difficult and uneconomical to manage as part of the public lands and is not suitable for management by another federal department or agency.
- It was acquired for a specific purpose and the tract is no longer required for that or any other federal purpose.
- Disposal of the tract will serve important public objectives.

There were 41,181 acres of public land identified in the Powder River RMP for possible disposal by sale, but no sales have been completed (BLM 1985c). A 640-acre tract of land was identified in the Big Dry RMP to be sold to Fallon County for a sanitary landfill and was completed in September of 2001 (BLM 1996). Although this is the only sale completed recently in the planning area, several others were completed in the early to mid-1980s (BLM 2010g).

The R&PP authorizes the sale of public lands for recreational or public purposes to state and local governments and to qualified non-profit organizations. Eight R&PP patents have been issued in the planning area; of these, three (for a game management area and two parks) were issued before the Powder River and Big Dry RMPs were completed. The Powder River RMP identified 331 acres of public land with potential for community expansion that could be considered for disposal under the R&PP (BLM 1985c). Four patents were issued for 36.02 acres in the Powder River RMP area: 0.84 acres for an historic cemetery in Carter County (1988), 11.83 acres for a college rodeo arena (1992), 7.72 acres for an administrative site for MFWP (1994), and 15.63 to the Eastern Montana Fair Board for Horseman’s Park (1998). The Big Dry RMP identified 2,700 acres of public land to be patented (under the R&PP) to MFWP as an addition to the Makoshika State Park (BLM 1996). Within the Big Dry RMP area, the Makoshika State Park R&PP patent was issued for 2,699.64 acres on June 6, 2000 (BLM 2010g).

The Powder River RMP categorized 123,542 acres of public land for potential disposal through exchanges or jurisdictional transfers (BLM 1985c). Disposal, retention, and acquisition criteria were established, and the disposal and retention lands identified on a map. The BLM would consider proposals from the public and react to other land adjustment proposals. Improved land ownership patterns would be achieved using exchange as the preferred method of land transaction (BLM 1985c). There have been 52,613.31 acres of public land disposed of in 15 exchanges in the Powder River RMP area and 23,324.10 acres acquired by exchange. One of these exchanges was an assembled land exchange in which 15,572.93 acres of scattered parcels of federal land were disposed of and 14,036.79 acres were acquired, which created a block of federal land of just over 20,500 acres. Ten of these exchanges were one-on-one exchanges where 12,912.50 public acres were disposed of and 9,287.31 acres of private land were acquired to block up with other public land. Following completion of one of these exchanges, the USFS received 1,036.91 acres of acquired land via jurisdictional transfer and the BLM acquired two access easements as a part of two of these exchanges. The Billings RMP area (under the jurisdiction of the Billings Field Office) used 11, 519.44 acres of public land in the Powder River RMP area for two pooling exchanges, but MCFO did not acquire any lands within the Powder River RMP area (under jurisdiction of the MCFO) through these two exchanges. There were 8,175.30 acres of public land patented within the Powder River RMP area to the State of Montana in the Phase III Exchange for the Crow Boundary Settlement Act (25 U.S.C. 1776), and 4,433.14 acres were patented within the Powder River RMP area to private individuals in the Phase IV Exchange for the Crow Boundary Settlement Act. The MCFO did not acquire any lands within the Powder River RMP area through these exchanges (BLM 2010g).

Prairie cordgrass on Cedar Creek

The Big Dry RMP provided that emphasis was placed on land tenure adjustment and easement acquisition within the planning area (BLM 1996). All land exchanges will be based on willing buyer and willing seller. The goal of the lands program is to consolidate the scattered public lands, increasing management efficiency and accessibility. Disposal, retention, and acquisition criteria were established, and disposal and retention areas identified on a map. Exchanges or acquisitions will be considered to acquire desirable tracts within the disposal areas or to add to existing public lands within those areas meeting the long-term management objective criteria. Individual tracts or parcels in the retention areas will be disposed or repositioned through sale or exchange when significant management efficiency, greater public values, or other objectives would be met. There were 6,586.05 acres of public land patented to the State of Montana within the Big Dry RMP area in the Phase II and III exchanges for the Crow Boundary Settlement Act. No other exchanges have been completed within the Big Dry RMP area (BLM 2010g).

Easements are sought to provide legal access to isolated tracts of public land and can be made a part of land exchange and sale transactions for access purposes (BLM 1985). The purchase of easements, execution of land exchanges, validation of Revised Statute 2477 ROWs, and reciprocal ROWs will continue to improve access (BLM 1996). There are 35 easements on record within the planning area: 7 non-exclusive easements for stockwater pipelines, 15 old exclusive (providing public access) access road easements (3 of which were acquired as part of land exchanges and 1 easement that acquired in return for a reciprocal ROW), and 13 easements acquired for access roads since the Powder River and Big Dry RMPs were completed. Three of these 13 easements were acquired as part of land exchanges, and one was acquired to provide access to public land blocked up by exchange. All of these more recent access easements are exclusive (except one non-exclusive easement with the right of access for the public and one non-exclusive easement that provides administrative access only). An older easement that no longer provided legal access because a highway was relocated was relinquished when it was replaced by a new easement that reestablished access (BLM 2010g).

There was one land transfer within the planning area from another agency to the BLM when the Army Corps of Engineers transferred 242.60 acres of land declared excess within the Big Dry RMP area in 1993 (BLM 2010g).

Excluding USFS acres (which are unknown), total withdrawals in the planning area include approximately 441,168 acres (BLM 1985c, 1996, 2010g) (Table 3-35). The withdrawals are either recommended for continuation of existing withdrawal or recommended for revocation of withdrawals. For continuation of existing withdrawals, all withdrawals and extensions on BLM-administered lands, having a specific period, must be reviewed by the Secretary of the USDI toward the end of the withdrawal period. The withdrawals may be extended or further extended only upon compliance with Title 43, Chapter 35, Subchapter II, and Section 1714 of the CFR and only if the Secretary determines that the purpose for which the withdrawal was first made requires the extension (and then only for a period no longer than the length of the original withdrawal period). For revocation actions, once relinquished, these lands would be opened to the public land laws and managed in a manner similar to that on adjacent public lands. See the *Lands and Realty-Renewable Energy Appendix* for more detailed descriptions of these withdrawals.

Zook Creek Wilderness Study Area in Rosebud County

TABLE 3-35.
LAND WITHDRAWALS IN THE PLANNING AREA

Type of Withdrawal	RMP Area	Name or Location	Acres Withdrawn
Continuation	Big Dry	International Boundary	293
	Big Dry	Medicine Lake National Wildlife Refuge	24,508
	Big Dry	Fox Lake Game Management Area	160
	Big Dry	Bureau of Sports Fisheries and Wildlife Waterfowl Production Area	26
	Big Dry	Charles M. Russell National Wildlife Refuge	290,222
	Big Dry	Corps of Engineers (Fort Peck)	3,756
	Big Dry	Fort Union Trading Post National Historic Site	62
	Big Dry and Powder River	Fort Keogh Livestock Experiment Station	55,765
	Powder River	Custer National Forest	Unknown
	Powder River	Belltower Town site	80
	Powder River	BIA-Northern Cheyenne Trust-Water Rights Settlement	320
	Powder River (a portion is within the Billings Field Office area)	BIA-Crow Trust-Crow Boundary Settlement	9,873
Continuation Subtotal			**385,065**[1]
Revocation	Big Dry	Lower Yellowstone Project	51,872
	Big Dry	Fort Buford Project	914
	Big Dry	Public Water Reserve 107 (McCone)[2]	238
	Big Dry	Milk River Project	37
	Big Dry	Corps of Engineers (Fort Peck)[3]	206,976
	Big Dry	Buffalo Rapids Project (BOR)	305
	Powder River	Power Sites Classification (Moorhead Reservoir area, surface only)	2,777
	Powder River	Tongue River Reservoir	160
Revocation Subtotal			**263,279**
Total Acres of Withdrawals			**441,168**[1]

[1]Total does not include USFS withdrawn acres, which are unknown.
[2] Of the 238 acres in Public Water Reserve 107, 200 lie within the Charles M. Russell National Wildlife Refuge. These acres are not included in the total acres of withdrawals.
[3] All of the Fort Peck Dam area overlaps the Charles M. Russell National Wildlife Refuge, so these acres are not included in the total acres of withdrawals.

SPECIAL DESIGNATION AREAS

This section describes the existing condition of special designations areas in the planning area. Special designations include:

- ACECs,
- Back Country Byways,
- National Trails,
- Wild and Scenic Rivers, and
- Wilderness and WSAs.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

ACECs are unique to the BLM and can only be designated on BLM-administered surfaces. BLM regulations define an ACEC as an area "within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards" (43 CFR Part 1610). While an ACEC may emphasize one or more unique resources, other existing multiple use management can continue within an ACEC as long as the uses do not impair the values for which the ACEC was designated. The MCFO administers 16 designated ACECs (Table 3-36 and Map 88). In addition, several areas were nominated for ACEC consideration (see the *Special Designations Appendix,* Nominated ACECs for more information.)

**TABLE 3-36.
AREAS OF CRITICAL ENVIRONMENTAL CONCERN ADMINISTERED BY THE MILES CITY FIELD OFFICE**

ACEC	Reason for Designation	Acres
Ash Creek Divide	Paleontological resources	7,931
Battle Butte	Cultural resources	120
Big Sheep Mountain	Cultural resources	360
Black-footed Ferret Reintroduction	Wildlife	11,166
Bug Creek	Paleontological resources	3,840
Finger Buttes	Scenery	1,520
Hell Creek	Paleontological resources	19,169
Hoe	Cultural resources	144
Howrey Island	Threatened and endangered wildlife	321
Jordan Bison Kill	Cultural resources	160
Piping Plover	Wildlife	16
Powder River Depot	Cultural resources	1,386
Reynolds Battlefield	Cultural resources	336
Sand Arroyo	Paleontological resources	9,056
Seline	Cultural resources	80
Smoky Butte	Geology, recreation	80
Total		**55,685**

Ash Creek Divide

The Ash Creek Divide ACEC, located in Garfield County, has produced fossils and research data proven significant to the national and global scientific communities (Map 42). This area has also generated scientific papers and yielded information regarding the types of animals and plants present, the environment in which they lived, and the cause of the mass extinction at the close of the Cretaceous Period. The Ash Creek Divide provides an example of the fossil record through exposed bedrock and high quality preserved fossils. The area is expected to provide further data as new material weathers out of the rock.

Battle Butte

The Battle Butte Battlefield is one of twelve major battlefields of the Sioux War of 1876 (Map 88). This war and associated sites are of major interest to national historians, history enthusiasts, and the Sioux, Crow, and Cheyenne Tribes. The Battle Butte ACEC, site of the Battle Butte or Wolf Mountains Battle, is located in Rosebud County. The battle was fought on January 8, 1877, in a blinding blizzard. Led by army scout Yellowstone Kelly, Colonel Nelson Miles commanded a force of 436 men composing seven companies of the 5th and 22nd

Infantry. They marched from the Tongue River Cantonment south along the Tongue River in search of American Indian winter villages. After a 10-day march up the river, Miles's command encountered warriors from Crazy Horse's winter camp of 1,200 inhabitants located south of Birney, Montana. Estimated at 600 warriors, the Sioux attacked west of the Tongue River and then occupied the high ground (Battle Butte) to the south of Miles's forces. The Sioux held the advantage, firing down into the U.S. soldiers' positions before Colonel Miles ordered his men to attack uphill to take command of this position. Once Miles's men were able to hold the high ground, the Sioux's advantage was lost. Low on ammunition, the Sioux retreated upstream and were able to escape up the Tongue River in the ensuing blizzard.

Big Sheep Mountain

The Big Sheep Mountain ACEC is located in Prairie County and represents a range of cultural periods dating back approximately 10,000 years (Map 88). Early residents used the area repeatedly and material left behind provides important information about time sequences and changes in use. The site contains projectile points, fire hearths, bone and tooth fragments, stone tools, and rock chips. The site's unique properties may contribute important scientific information on nearly the full range of cultural traditions from the Paleo-Indian period to the Late Plains Archaic Period (3,000 to 1,500 before present).

Black-footed Ferret Reintroduction

The Black-footed Ferret Reintroduction ACEC is located in Custer and Prairie counties (Map 89). The black-footed ferret is an endangered species dependent on prairie dog colonies. In order for the black-footed ferret to recover, it will be necessary to establish 10 separate self-sustaining colonies; however, because there may not be 10 suitable reintroduction sites in the United States, all reintroduction areas are nationally important. This area is considered a potential reintroduction area because it contains active prairie dog towns on public lands.

In addition to the endangered black-footed ferret, burrowing owls, swift fox, and mountain plovers are also associated with prairie dog habitat. When this ACEC was designated, it contained approximately 1,151 public acres of active prairie dog towns, but plague has reduced the active area to about 435 acres and an additional 182 acres (within the same complex) on public lands outside the ACEC.

Bug Creek

The Bug Creek ACEC, located in McCone County, contains portions of the Hell Creek formation and the overlying Tullock member of the Fort Union formation, which are significant for paleontological resources spanning the late Cretaceous Period (100 to 65 million years ago) to the early Tertiary Period (65 to 25 million years ago) (Map 43). The outcrops of these beds are some of the few places in the world that preserve a continuous record before, during, and after the mass extinction of the dinosaurs and other major life forms. Because it contains extensive exposures of bedrock and quality preserved fossils, the Bug Creek area is one of the preeminent and most studied examples of this fossil record. Fossils and other data collected in this area yield information about the end of the dinosaur age and the start of the mammal age.

Finger Buttes

The Finger Buttes ACEC is located in Carter County and no legal access is available (Map 90). Part of the Arikaree formation, the Finger Buttes represent more than badlands topography (typical topography for southeastern Montana) and contain scenic qualities of color, line, and form in tall, slim, smokestack-like tan to gray sandstone monuments, towers, and prominences. Highlighted against the horizon, the scenic values are unique and do not exist elsewhere in the region.

An area in Carter County has been identified for an oil and gas master leasing plan (MLP) (see *Oil and Gas* for more information on MLPs). The 1,521 acres Finger Buttes ACEC, which was designated for scenic values in 1996, is located within the proposed MLP area. The ACEC has low potential for oil and gas development. For more information on the ACEC, see the *Special Designation Areas Appendix.*

Hell Creek

The Hell Creek ACEC is located in Garfield County (Map 44). The Hell Creek ACEC's fossils and research data are significant to the national and global scientific communities, generating scientific papers and populating museum displays. Comparison of fossils and other data collected yielded information about the types of animals and plants that occurred in the area, the environment in which they lived, and the cause and effects of the mass extinction at the close of the Cretaceous Period. Approximately one-half of the Hell Creek NNL is included within the ACEC boundaries. The area is expected to provide further data as new material weathers out of rock.

Hoe

The outstanding feature of the Hoe ACEC, located in Prairie County, is three bison scapulas (shoulder blades) used as gardening hoes (Map 88). American Indian use, documented by projectile points and pottery fragments, occurred during the Late Prehistoric Period (1,500 BP to 200 BP). Several fragments of pottery, a bone awl, stone tools and flakes, and fire-cracked rock indicate farming and non-nomadic lifestyles, typical of the tribes in the middle Missouri River region in North and South Dakota that lived in permanent villages and tended gardens. Because Montana has a short growing season, sites of this type are not usually found in this state, and this ACEC represents the western-most findings of the middle Missouri tradition of agriculture.

Howrey Island

The Howrey Island ACEC, located in Treasure County, is one of the few BLM-administered islands in the Yellowstone River (Map 82). White-tailed deer, ring-necked pheasants, numerous furbearers, and various non-game species are among the variety of wildlife inhabiting the island. An active bald eagle nest, which has successfully fledged young birds for a number of years, is also present. This ACEC is also nesting and brood-rearing habitat for Canada geese and other waterfowl species. Howrey Island is designated a watchable wildlife area and contains a self-guided nature trail for public use.

Jordan Bison Kill

The Jordan Bison Kill ACEC, located in Garfield County, is a 2,000-year-old bison jump, a rarity in the planning area (Map 88). A sandstone cliff forms the main part of the kill site, and a nearby prehistoric campsite is associated with the jump. According to results of carbon dating, the campsite was used at least twice.

Piping Plover

The Piping Plover ACEC is located in Sheridan County (Map 91). The piping plover is a threatened bird species associated with saline wetlands, typical of northeastern Montana. One parcel of BLM-administered land in Sheridan County, bordering a saline wetland near the town of Westby, is known to contain nesting piping plovers.

Powder River Depot

The Powder River Depot (site of the Powder River Depot ACEC), located in Prairie County, was the main supply depot for the armies that pursued the fleeing Sioux and Cheyenne Tribes throughout the summer of 1876 (during the Sioux War). This area contains a wealth of archeological information regarding the encampment and everyday life of the soldiers. The Powder River Depot was the location of General Terry's supply depot that supplied General Custer's troops before they left for the Battle of Little Bighorn. Left behind were three infantry companies, the 7th Cavalry band, personnel lacking proper equipment or suitable mounts, some civilian personnel, and wagons used in the march from Fort Lincoln. As many as 3,000 soldiers camped at the depot during the peak of the occupation (Map 88).

Reynolds Battlefield

The Reynolds Battlefield ACEC, one of twelve battlefields in the region and the site of the first major battle of the Sioux War of 1876, is located in Powder River County (Map 88). The Big Horn Expedition, under the command of General Crook, left Fort Fetterman, Wyoming, in mid-February and endured almost continual harsh winter weather with sub-zero temperatures. Marching north up the Powder River drainage, they crossed into Montana near Decker and proceeded down the Tongue River to Hanging Woman Creek. There Colonel Joseph J. Reynolds, with six companies of the 2nd and 3rd Cavalry, attacked the only village they found, which was located east on the Powder River. The attack began at dawn on March 17, 1876. In the early morning battle, the troops captured the village and some 800 horses and burned all of the camp tepees, although most of the inhabitants were able to escape. The village retaliated by firing down into the army positions from a high bluff to the west, and the troops withdrew under heavy fire. Their hasty withdrawal, ordered by Reynolds, left four dead soldiers in the field. Later that night, the village recaptured their horse herd. General Crook, enraged by these events, ordered Reynolds court-martialed. Compounding the defeat, the village was not, in fact, Sitting Bull's Sioux camp, as originally thought, but a Cheyenne camp on the way back to the reservation. This unprovoked attack on a peaceable camp turned the Cheyenne against the United States government, and they soon sided with the Sioux and participated in subsequent phases of the war.

Sand Arroyo

The geologic formations and associated fossils of the Sand Arroyo ACEC, located in McCone County, are a rare example of a continuous record of the end of the dinosaur age, the close of the Cretaceous Period, and the subsequent beginning of the age of the mammals at the start of the Tertiary Period (Map 45). This area preserves a quality record of this period and is globally rare. The focus of past field studies, the area has produced fossils for display and research because the necessary combination of bedrock exposure of the proper age and quality preservation of fossils provides research and collecting opportunities rare for this geological period.

Seline

The Seline ACEC, located in Dawson County, contains a 3,000-year-old site representing the trap method of bison killing (in which bison were herded up a narrowing or steep-ended draw before being killed with spears or arrows). The trap method served to slow and concentrate the bison, making them easier prey for the hunters (Map 88).

Scenic view of the Finger Buttes Area of Critical Environmental Concern

Smoky Butte

The Smoky Butte ACEC, located in Garfield County, a landmark feature that guided early travelers to the area, is legally inaccessible (Map 92). The rocks present at Smoky Butte contain rare minerals including armalcolite (a mineral found in samples of rock from the moon) and davanite, a recently described alkali titanosilicate mineral also found in Siberia) and which was discovered in Smoky Butte lamproite by Wagner and Velde (1986). Matson (1958) noted that one of the most striking features of the intrusive rock complex is their high potassium and titanium content and similarity to rocks found at West Kimberly, Australia, and the Leucite Hills of Wyoming.

The area was the subject of research by American, Canadian, and French scientists, and it was the location of a special field trip of the 28th International Geological Congress studying the Montana High Potassium Igneous Province in July 1989. Information from this area has been useful in drawing conclusions and advancing theories regarding the origin of the rocks as well as the composition and geotectonics of the earth's mantle.

BACK COUNTRY BYWAYS

The BLM MCFO manages the 105-mile Big Sky Back Country Byway, which runs through Prairie, McCone, and Roosevelt counties (Map 48). The Back Country Byway was designated in 2000 to provide opportunity for local communities, provide economic relief, and link the two major rivers in the Lewis and Clark Expedition, the Yellowstone and the Missouri. This route also runs along a homesteader's route called the RY-Trail, which linked Regina, Canada, with Yellowstone National Park. There are three kiosk locations along the Big Sky Back Country Byway in the rural towns of Terry, Circle, and Wolf Point. A fourth interpretive kiosk is located adjacent to State Highway 13, on the southeast side of the old historic bridge near Wolf Point. Historical and cultural resources, fishing opportunities, wildlife viewing, moss agate rock collecting, big game hunting, a world-class zone noted for paleontology, and rich history associated with the First Nations People are highlights of the byway.

NATIONAL TRAILS

Lewis and Clark National Historic Trail

The Lewis and Clark National Historic Trail was designated in 1978 in recognition of the historic expedition by Lewis and Clark from 1804 to 1806. A portion of the Yellowstone River along the Lewis and Clark National Historic Trail is the route traveled by William Clark in July of 1806, during the expedition's return trip. This area contains approximately 16,000 acres of BLM-administered lands (Map 49).

The nature and purpose of this national historic trail is to follow as closely as possible and practicable the original trails or routes of travel of national historic significance and have as their purpose the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment (National Trails System Act of 1968 [16 U.S.C. 1241-1249]). The primary purpose, specific to the Lewis and Clark National Historic Trail (NPS 1982), is commemoration of the historic event that forms the Trail's central theme. The identification and preservation of the historic and cultural resources related to the events are one aspect of commemoration. The other aspect is public use, which should take the form of interpretation of the historic events and approximate retracement of the historic route. The BLM will manage the portion of the Lewis and Clark National Historic Trail within the planning area in a manner that is consistent with the purposes and provisions of the National Trails System Act (PL 90-543, 1968, as amended by PL 95-625, 1978). The NPS *Lewis and Clark National Historic Trail Comprehensive Management Plan* (1982) outlines management objectives, practices, and responsibilities and emphasizes partnerships in trail administration. Scenic and cultural values will be protected on BLM-administered land along this historic trail.

Four recreation sites are also located within the Lewis and Clark National Historic Trail: Howrey Island Recreation Area, Matthews Recreation Site, Calypso SRMA, and the Powder River Depot SRMA. See the *Recreation* section for more information about the Lewis and Clark Trail.

WILD AND SCENIC RIVERS

As required under the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.), rivers in the planning area were inventoried and studied for values that would contribute to their consideration as wild and scenic rivers. However, no rivers or river segments were found to contain one or more outstandingly remarkable values along their BLM-administered segments, which eliminated these areas from consideration for designation. See the *Special Designation Areas Appendix* for detailed information about the wild and scenic river evaluation process used in the planning area.

WILDERNESS

There are no designated wilderness areas within the planning area.

WILDERNESS STUDY AREAS

Background

The BLM's 1995 *Interim Management Policy and Guidelines for Lands under Wilderness Review* states:

> "Under FLPMA, wilderness preservation is part of BLM's multiple-use mandate, and wilderness values are recognized as part of the spectrum of resource values considered in the land-use planning process. Section 603 of FLPMA specifically directed the BLM, for the first time, to carry out a wilderness review of the public lands."

It further states:

> "The wilderness review required by section 603 of FLPMA focused on roadless areas of 5,000 acres or more and on roadless islands. The BLM as a matter of policy used its general management authority under Sections 302 and 202 of FLPMA to include in the wilderness review certain other roadless areas. These included: (1) areas smaller than 5,000 acres that were not islands, (2) areas less than 5,000 acres that had wilderness characteristics in association with contiguous roadless lands managed by another agency, and (3) lands placed under BLM administration after the wilderness inventory was conducted in 1978 – 80."

FLPMA mandated that, within 15 years, the BLM would inventory and study its lands for their wilderness suitability, and based on this review, the Secretary of the Interior would forward wilderness recommendations to the President. Recommendations for those areas within the MCFO were included in the *Montana Statewide Wilderness Study Report* released in September 1991 (BLM 1991b). Recommendations were signed by the Secretary of the Interior and by the President, and forwarded to Congress before the end of that year. Seven WSAs were identified by the inventory and study conducted on lands in the planning area.

Section 603(c) of FLPMA states:

> "During the period of review of such areas and until Congress has determined otherwise, the Secretary shall continue to manage such lands according to his authority under this Act and other applicable law in a manner so as not to impair the suitability of such areas for preservation as wilderness..." (43 U.S.C. 1782).

This language is intended to ensure that the option to either designate lands as wilderness or release them from further consideration as wilderness rests with Congress. It also makes it clear that BLM's responsibility is to ensure that wilderness values on those lands are not degraded until Congress can make a final determination as to the suitability of those lands for inclusion in the National Wilderness Preservation System. BLM actions may not preempt the authority of Congress to make a final decision on lands that were studied, regardless of whether they were recommended by the BLM as suitable for wilderness designation or not. Even through the land use planning process, BLM may not assert any further authority over the designation, or release, of lands studied under Section 603 of FLPMA.

Current Management

The MCFO manages seven WSAs with a total of approximately 97,248 acres of BLM-administered lands (Table 3-37 and Map 88). Six of these WSAs were studied under the authority of Section 603, and one was studied under Section 202. The WSAs are managed as a limited area for OHV uses, which allow vehicle use only on the inventoried roads and ways that existed at the time of inventory. In accordance with BLM Manual 6330, *Management of Wilderness Study Areas*, monitoring of WSAs is conducted on a monthly basis as staffing, funding, and weather permit. Alternative methods of monitoring will also be used (such as reconnaissance flights over WSAs that are not legally accessible because of private land ownership patterns).

Per the *Montana Statewide Wilderness Study Report, Volume II, Wilderness Study Area Specific Recommendations*, September 1991, the MCFO had an acquisition of three privately owned sections of land within the Terry Badlands WSA. These lands were inholdings at the time the WSA was studied for wilderness potential and changed the total area recommendations. This acquisition contained 1,960 acres with outstanding wilderness characteristics, per the report.

TABLE 3-37.
WILDERNESS STUDY AREAS MANAGED BY THE MILES CITY FIELD OFFICE

WSA Name	WSA Number	FLPMA Section	Total Acres	Acres Recommended for Wilderness	Acres Recommended for Non-wilderness
Billy Creek	MT-024-633	202	**3,450**	0	3,450
Bridge Coulee	MT-024-675	603	**5,900**	0	5,900
Buffalo Creek	MT-027-702	603	**5,650**	0	5,650
Musselshell Breaks	MT-024-677	603	**8,650**	0	8,650
Seven Blackfoot	MT-024-657C	603	**20,250**	5,710	14,540
Terry Badlands	MT-024-684	603	**44,910**	33,024	11,886
Zook Creek	MT-027-701	603	**8,438**	0	8,438
Total			**97,248**	**38,734 (40% of total WSA acres)**	**58,514 (60% of total WSA acres)**

SOCIAL AND ECONOMIC

SOCIAL CONDITIONS

This section discusses the social conditions in the planning area, which includes 17 counties in eastern Montana. The counties with the most amount of BLM-administered surface include Carter (503,615 acres), Garfield (502,191 acres), Prairie (449,183 acres), Custer (336,376), Powder River (258,865 acres), Rosebud (234,303 acres), McCone (200,775), and Fallon (117,453 acres). All other counties have less than 100,000 acres of BLM-administered surface. All of these counties have at least 600,000 acres of BLM-administered mineral acres except Big Horn, Daniels, Fallon, Roosevelt, Treasure, Valley, and Wibaux counties. Some of these counties (such as Carter, Garfield, McCone, Powder River, Prairie, Richland, and Sheridan) have more than 50 percent of their county acreage in BLM-administered minerals. Oil-related leasing and development occurs primarily in Dawson, Fallon, Powder River, Prairie, Richland, and Wibaux counties, and gas-related leasing and development occurs in Big Horn, Carter, Custer, Fallon, Richland, and Wibaux counties. Coal development occurs in Big Horn, Richland, and Rosebud counties. BLM-administered grazing and recreation lands are concentrated in the areas containing the majority of the public surface acres.

Social Trends and Attitudes

This section focuses on social trends and attitudes that affect BLM land management. This information is important to land management decision makers because the trends and attitudes can affect relationships between the agency and its constituents, the ability to successfully implement plans, and the potential impacts to communities (both communities in the geographical sense and communities of interest).

Changes in the management of BLM-administered lands are just one aspect of a broader debate in environmental and resource management occurring locally, nationally, and globally. Commodity, amenity, environmental quality, ecological recreation, and spiritual are all social land and natural resource values. While the emphasis on the commodity value of public lands has been prevalent in the past, a study examining public attitudes toward ecosystem management in the United States found "generally favorable attitudes toward ecosystem management [defined as maintaining and ensuring sustainability] among the general public (Bengston, Xu, and Fan 2001)."

In the rural West, in places where land use has been relatively unrestricted, some individuals and groups have expressed concern regarding the control and management of BLM-administered lands. People with these concerns feel that government officials and environmental advocacy groups that do not have a true understanding of the lands or local residents who depend upon these lands for income and recreation drive change in BLM land management. Of particular concern is the loss of current land uses such as livestock grazing and OHV use. People with these concerns seek to balance what they consider environmental extremism with economic and human concerns, and they may feel that local elected officials are more closely in touch on a daily basis and better equipped to make decisions about BLM-administered lands than federal managers located elsewhere.

The MCFO's area of influence contains a significant amount of federal ownership. The counties in the planning area contain portions of the Custer National Forest, the Charles M. Russell National Wildlife Refuge, and other small, federally managed areas. Because some members of the public do not readily differentiate between the various federal land management agencies, activities by other federal agencies may affect perceptions about the BLM. General attitudes towards the federal government, in some cases unrelated to specific BLM activities, may also influence attitudes towards the BLM.

The major trends affecting BLM's land management of the MCFO area are described below.

- The increasing popularity of BLM-administered land for recreation. A comprehensive report on recreation by Cordell et al. (1999) indicate that demand in the Rocky Mountain West for recreation activities will increase substantially by the year 2020, with non-consumptive wildlife activities, sightseeing, and visiting historic places increasing the most.
- Concern regarding access to BLM-administered land and the loss of public access to some private land is adding pressure to BLM-administered lands. These changes, linked to the pursuit of a quality recreation experience, occur for a variety of reasons, which include the purchase of lands for private use, leases to outfitters for exclusive use, and closure of private land and roads to avoid problems of safety, fire, fences, weed, litter, and open gates.
- Aging population is another trend occurring in the nation and Montana; in 2010, 20 percent of the population in the planning area was 65 or older, compared to a statewide figure of 15 percent. For the state as a whole, the percentage of population 65 or older is expected to increase to 25 percent by 2025. The percentage of people 65 or older is actually increasing more rapidly in states like Montana because young people are more likely to leave for advanced education, military service, and employment opportunities unavailable locally.

Planning Area Demographics and Quality of Life

In 2010, the estimated population of the planning area was 87,085, which was less than one-tenth of the population of the entire state. County populations ranged from over 10,000 in Custer, Big Horn, and Roosevelt counties to less than 2,000 in Carter, Treasure, Wibaux, Prairie, Powder River, McCone, Daniels, and Garfield counties. The 2010 planning area population estimate represented a decline of 6 percent since 2000, with all counties losing population except Big Horn, Richland, and Fallon counties. Custer, the largest county in the planning area, neither lost nor gained population during the decade. Population losses among the other counties included population losses greater than 13 percent in Carter, Daniels, Sheridan, and Treasure counties. Migration patterns in the planning area indicated a net loss of over 7,000 people between 2000 and 2008. All counties lost population through migration, with the biggest losses occurring in Big Horn, Sheridan, and Roosevelt counties.

Cattle grazing in front of an oil pump in the planning area

The average population density (persons per square mile) was less than two people per square mile in the planning area, compared to a state figure of 6.8. Population density ranged from a low of 0.3 persons per square mile in Garfield and Carter counties to highs of 4.4 to 4.7 in Richland and Roosevelt counties.

The largest community is Miles City in Custer County, located in the southern part of the planning area. Miles City, with a 2010 population of 8,123, was the only community in the entire planning area with a population greater than 5,000. Between 2000 and 2010, Miles City's population declined 2.4 percent. Other communities in the planning area with 2010 populations greater than 1,000 include Sidney in Richland County (with a population of 4,843), Glendive in Dawson County (4,628), Hardin in Big Horn County (3,532), Glasgow in Valley County (2,870), Wolf Point in Roosevelt County (2,557), Colstrip in Rosebud County (2,377), Forsyth in Rosebud County (1,865), Plentywood in Sheridan County (1,638), and Baker in Fallon County (1,640). Some of the communities in the planning area, such as Sidney (Richland County) and Glendive (Dawson County), are currently experiencing an influx of population related to the oil and gas development in western North Dakota. While increases in business are bringing money into these communities, there are associated social problems, such as increased traffic and crime and increased competition for housing and public services.

In 2010, 20 percent of the planning area residents were 65 years and older in comparison to a statewide figure of 15 percent (Table 3-38). Figures for the different counties ranged from 10 percent in Big Horn County to 26 percent in Prairie County. Eighty-seven percent were White and 11 percent were American Indian in the planning area, in comparison to statewide figures of 89 percent and 6 percent. In 2008, 88 percent of persons over 25 were high school graduates, compared to a statewide figure of 90 percent. The planning area counties had poverty rates (percentage persons below poverty level in 2009) ranging from 9.1 percent in Fallon County to 30.7 percent in Roosevelt County. The planning area county average was 15.7 percent, compared to 15.0 percent for the state as a whole.

Two Indian reservations are located in the planning area: the Northern Cheyenne Reservation is located in Big Horn and Rosebud counties, and the Fort Peck Reservation is located primarily in Roosevelt County. The Crow Reservation is located in Big Horn County directly adjacent to the Northern Cheyenne Reservation and the western boundary of the planning area. In addition, the Turtle Mountain Reservation of North Dakota (home to the Turtle Mountain Band of Chippewa Indians), has scattered land in Sheridan and Roosevelt counties. Big Horn and Roosevelt counties are over 60 percent American Indian while Rosebud County is about 35 percent American Indian (Table 3-39). The population on the Fort Peck Reservation was 10,998 people in 2010, with 67 percent American Indian. The population of the Crow Reservation was 6,863, with 78 percent American Indian. The population of the Northern Cheyenne Reservation was 4,789 in 2010, with 92 percent American Indian. Counties with Indian Reservations tend to contain younger populations and a higher percentage of persons living below the poverty level.

TABLE 3-38.
POPULATION AND SOCIAL CHARACTERISTICS IN THE PLANNING AREA

County	Population 2010	Percentage Change 2000 to 2010 (%)	Net Migration 2000 to 2008	Persons Per Square Mile, 2010	Percentage Age 65 and Over, 2010 (%)	Percentage High School Graduates, 25 and Over (2005 to 2009)
Big Horn	12,865	1.5	-1,077	2.8	10.0	82.4
Carter	1,160	-14.7	-93	0.3	23.2	91.5
Custer	11,699	0.0	-466	3.1	17.5	91.5
Daniels	1,751	-13.2	-201	1.2	24.8	94.7
Dawson	8.966	-1.0	-342	3.8	17.9	89.0
Fallon	2,890	1.9	-134	1.8	17.4	88.1
Garfield	1,206	-5.7	-141	0.3	20.6	90.9
McCone	1,734	-12.3	-324	0.7	22.0	91.6
Powder River	1,743	-6.2	-121	0.5	22.7	92.3
Prairie	1,179	-1.7	-10	0.7	26.0	85.8
Richland	9,746	0.8	-307	4.7	14.9	85.2
Roosevelt	10,425	-1.8	-1,189	4.4	10.8	88.7
Rosebud	9,233	-1.6	-1,004	1.8	11.5	88.5
Sheridan	3,384	-17.6	-511	2.0	23.1	84.9
Treasure	718	-16.6	-240	0.7	23.8	89.7
Valley	7,369	-4.0	-792	1.5	20.7	86.6
Wibaux	1,017	-4.8	-65	1.1	23.9	80.8
Planning Area Total	**87,085**	**-5.7**	**7,017**	**1.8**	**19.5**	**88.4**
State of Montana	**989,415**	**9.7**	**42,980**	**6.8**	**14.8**	**90.4**

Source: United States Bureau of the Census 2010a

In describing the planning area quality of life, there are many positive factors. The area's remoteness and sparse population reduces or avoids many urban problems such as crime and overcrowding. Recreational opportunities are plentiful. Conversely, services such as health care and education are lacking in some communities. The percentage of persons living below the poverty level is higher in many planning area counties than for the state as a whole. However, this picture may currently be undergoing change in some areas as they experience the effects of oil and gas development.

Information on social conditions for a large portion of the study area (based on discussions with 100 residents in the study area), indicated that most residents believed their lifestyle needs were being met (BLM 1995). Those who said that their needs were not being met indicated that the lack of cultural activities and tough economic times were the key challenges. Other important positive contributors to quality of life were proximity to the outdoors and wide-open spaces, good people, small town atmosphere, an active and supportive community, an ability to earn a living, and opportunity for outdoor recreation. The area was also considered a good place to raise children (BLM 2005g).

Affected Groups

The following discussion of affected groups is intended to facilitate the assessment of social impacts. This simplified discussion of affected groups' values and attitudes is based on previous studies, surveys, and scoping information collected for this project. Some people may fall into more than one affected group, and their values and attitudes may change over time.

TABLE 3-39.
RACE AND POVERTY IN THE PLANNING AREA

County	Percentage White (%)	Percentage American Indian (%)	Median Household Income, 2009	Percentage Persons Below Poverty Level, 2009 (%)
Big Horn	31.4	64.3	$32,223	24.0
Carter	97.8	0.9	$31,800	21.1
Custer	95.5	1.7	$38,844	14.2
Daniels	95.7	2.1	$35,005	13.5
Dawson	95.7	1.7	$44,847	12.6
Fallon	97.4	1.4	$46,936	9.1
Garfield	98.6	0.4	$32,359	17.4
McCone	98.0	0.4	$38,049	17.2
Powder River	95.0	1.5	$35,138	13.0
Prairie	96.4	0.2	$33,228	15.3
Richland	95.0	1.7	$50,014	10.3
Roosevelt	35.8	60.4	$30,455	30.7
Rosebud	61.3	34.7	$45,146	17.2
Sheridan	95.4	1.7	$42,294	11.6
Treasure	93.9	0.8	$39,034	12.2
Valley	87.0	9.8	$38,274	14.3
Wibaux	97.6	0.4	$36,604	12.9
Planning Area Total	**86.5**	**10.8**	**$38,254**	**15.7**
State of Montana	**89.4**	**6.3**	**$42,222**	**15.0**

Source: United States Bureau of the Census 2010a

Livestock Permittees

Ranching is an important part of the history, culture, and economy of the study area. In 2007, there were 7,346 farms and ranches in the study area. This figure indicates 25 percent of the ranches and 42 percent of the lands in farms and ranches in Montana are located in the planning area. Many livestock operators in the planning area hold livestock grazing permits on public lands. Ranchers face many challenges today including changes in federal regulations, economic issues, and changing land use. Ranchers and permittees may face increasingly stressful social situations as they try to balance their traditional lifestyles with demands from government agencies and other public land users such as recreationists.

Changes that are occurring in the planning area include an increase in land sales for recreation purposes, primarily hunting, which can result in ranches being divided into smaller units. Often the new owners lease the ranch (including BLM-administered lands) for grazing and use the land for recreation. In many cases, particularly in land with scenic values, the recreational value of property has become more important than the agricultural values. Some ranchers are diversifying their operations by guiding hunters or other recreationists or making land available to outfitters. These activities can cause problems with recreationists who have traditionally used private lands to access adjacent public lands. The tradition of ranching as a multi-generational livelihood is also changing with the selling of leasing of family ranches when an estate is settled instead of continued operated by the next generation. However, these changes are not occurring as quickly in eastern Montana as they are in other parts of Montana and the West.

Concerns about livestock grazing received during scoping included potential conflicts between recreation users and grazing leaseholders, increasing or maintaining AUMs on grazing allotments, maintaining AUMs to accommodate other uses, prairie dog management, invasive weed species, the continued use of OHVs to monitor leases, and suggestions that the BLM manage with greater flexibility from year to year and place to place. The importance of the use of federal land to graze livestock as an essential part of the local way of life and heritage was also emphasized and many commenters indicated that they felt that local comments should carry more weight than those from out of state.

Recreationists

Recreation is a component of most lifestyles in the study area. According to University of Montana research, Montanans take more leisure trips than the United States average (MFWP 2008). The substantial recreational opportunities for fishing, hunting, hiking, horseback riding, OHV use, and sightseeing are important elements of the overall quality of life for study area residents. The BLM manages recreation not for the activities but for beneficial outcomes produced in the social, economic, and environmental arenas (see the *Recreation Appendix*). This framework ensures sustainable production and realization of desired outcomes by visitors, communities and their residents, and the environment.

Recreationists represent very diverse groups of people, and changes in recreation management can affect people who engage in the various activities differently based on need and preference. Recreationists tend to organize into interest groups; most recreational activities have at least one organization that advocates for their particular activity. In addition to recreation use by local residents, some destinations in the area attract visitors from other areas of the United States for fishing, hunting, and other recreational activities.

The *Montana Statewide Comprehensive Outdoor Recreation Plan* outlined key issues based on statewide surveys and other research (MFWP 2008). The following are some of the key issues relevant to BLM-administered lands in the planning area:

- a need for continued access to, and maintenance of, rural and backcountry trails and use areas for hiking, biking, skiing, and equine and motorized (OHV, snowmobile) recreation;
- a need for increased miles and maintenance of urban and rural trails and access for water-based recreation; and
- insufficient quality and quantity of recreation facilities for youth.

Outfitters and guides use recreational opportunities in the study area for economic gain. Some outfitters and guides are ranchers or farmers who use recreation as a means to achieve economic diversification. Others operate full-time or seasonal outfitter businesses and employ some local residents as guides, while still others are permanent full-time independent guides who have their own clients, both local and non-local. Approximately 48 outfitters and guides are permitted by the MCFO. Most of the BLM permits are for hunting, campouts, and wagon trains, but outfitters and guides can request permits for a variety of other uses. A fee is assessed for commercial permits. Some residents do not want permits to be issued to outfitters and guides because they believe that permitted outfitters have unfair and exclusive access to federal lands legally inaccessible to the public (BLM 2005g).

Concerns from recreationists include conflicts between ranchers and recreationists, conflicts among recreationists (particularly motorized and non-motorized users), greater enforcement of OHV use, access to isolated parcels of BLM-administered land, and designation of areas for motorized and non-motorized use.

Groups and Individuals Who Give a High Priority to Resource Protection

Various individuals and groups at the local, regional, and national levels are interested in the ways BLM manages public lands. Many of these concerns regard wildlife, water quality, and visual quality. They value BLM-administered land for wildlife, recreation, education, scenic qualities, wilderness, and open space, among other reasons. Specific concerns received during scoping for this RMP included concern about energy development and the associated potential impacts, the proliferation of pipelines without consideration of planned corridors, sage-grouse and other bird species populations and habitat protection, black-footed ferret reintroduction, preservation of water quantity and quality, and unregulated OHV use. The use of conservation easements for resource protection was also supported.

Groups and Individuals Who Give a High Priority to Resource Use

Individuals and groups, including many local residents, are concerned about limitations on the availability of public lands for commercial uses, such as livestock grazing and mineral or energy development. They indicate that the public lands have to be managed to be as productive as possible and the survival of local economies and local communities depend upon these industries (BLM 2003l). Comments from oil and gas companies indicated concern for negative or excessive rules that would hinder development and lead to limited production and revenues, an interest in the use of adaptive management, and the assessment of mitigation measures during planning.

Local Communities

The planning area population is mainly rural, with many small towns and communities and strong ties to the land. Small rural communities can be tied to BLM-administered and public lands in a variety of ways. Local businesses and governments depend upon BLM employees to support businesses and public services, while use of public lands for recreation activities, livestock grazing, minerals or energy development, and other activities can provide economic and leisure-time opportunities.

Information from discussions with area residents indicates that concern about local economic conditions was predominant among the participants (BLM 2003l). Area residents were concerned about young people and families leaving the area to seek employment elsewhere, declining farm populations, local business closings, and lack of funds for public services resulting from the declining tax base. Some participants thought BLM should consider economic impacts to local communities when making land use decisions and manage lands with high recreational potential more aggressively because communities could benefit economically.

Some residents of rural communities may feel reluctance toward short-term developments (such as mineral or energy developments) that could alter their lifestyle (BLM 2003l). Many, especially those in ranching and irrigated agriculture, are concerned with water quality and quantity as well as soil quality. This sometimes leads to tension between the desire for new development to support the often-stagnant rural economies and the concern that such development could harm the environment and the traditional lifestyle qualities. Those who own land or would otherwise benefit from mineral and energy development projects tend to favor cautious and prudent development to realize the individual and community economic benefits such projects may bring (BLM 2003l). Some who do not stand to benefit directly also favor responsible development and believe that the economic benefits are needed to support the local economy.

Other individuals are concerned that the quality of life and the environment will be adversely affected, that local benefits will be minor, and that most of the benefits will accrue to outsiders. Areas where energy resources are developed often see an influx of people from other areas (BLM 2003l). Many of these people see their employment as temporary, expect to move on to other areas, and do not play an integral part in community affairs. Long-term local residents often resent these outsiders while at the same time realizing some economic benefits from the business and service demands of these newcomers.

A small but growing population includes professionals, craftspeople, retirees, and others who have moved to small towns to enjoy various amenities and the slower pace of life and (BLM 2003l). While the forested areas of western Montana tend to attract more of this group than eastern Montana, these people are present in the planning area as well, and they may oppose development proposals that appear to jeopardize the quality of their new lifestyles (BLM 2005g).

Local community concerns received during scoping included payment in lieu of taxes (PILT), management of invasive weed species and fires, continued use of OHVs, development to support local communities, and emphasis on local comments versus out-of-state comments.

American Indians

Three American Indian Reservations are located in or near the planning area. The Crow and Northern Cheyenne Reservations are adjacent to each other in the southeastern part of the planning area, in Big Horn and Rosebud counties. The Fort Peck Reservation, which is home to the Assiniboine and Sioux Tribes, is located in the northern part of the planning area. In addition, the Turtle Mountain Reservation of North Dakota has scattered land in Sheridan and Roosevelt counties. Other tribes have also shown an interest in the area (see *Tribal Interests*). According to Deaver (1986), the following types of traditional contemporary religious sites may be identifiable in the planning area: vision quest sites, rock art sites, burials, habitation sites, and dance grounds. Hunting and plant gathering (for religious or ceremonial purposes) also occur in the planning area. Concerns received from various tribes during tribal consultation included various methods of protection for cultural resources, oil and gas leasing, sage-grouse declines, overgrazing, erosion, and other resource issues.

Environmental Justice

Executive Order 12898 (February 11, 1994) requires each federal agency to identify and address the "…disproportionately high and adverse human or environmental effects of its program, policies, and activities on minority populations and low income populations."

American Indians represent nearly 11 of the population in the planning area and are concentrated in Big Horn, Rosebud, and Roosevelt counties, which also contain the Crow, Northern Cheyenne, and Fort Peck Reservation communities. Over 16,000 American Indians live on these reservations, and all of these reservations have high percentages of people living in poverty and very high unemployment rates in comparison to the rest of the planning area and the state as a whole (BLM 2005g).

In 2009, the percentage of persons below the poverty level for counties in the planning area was more than 15 percent, which was similar to the statewide figure. Figures for individual counties ranged from a low of 9 percent in Fallon County to more than 20 percent in Big Horn and Carter counties and over 30 percent in Roosevelt County.

Tribal Interests

BLM coordination or consultation with American Indians, as it pertains to tribal interests, treaty rights and trust responsibilities, is conducted in accordance with the following direction:

- BLM Manual Handbook H-8120-1, *Guidelines for Conducting Tribal Consultation* (transmitted December 3, 2004);
- Executive Order No. 13084 , Consultation and Coordination with Indian Tribal Governments (May 14, 1998);
- *Government-to-Government Relations with Native American Tribal Governments* (Memorandum signed by President Clinton on April 29, 1994); and
- Order No. 3175, Departmental Responsibilities for Indian Trust Resources (Section 2 of Reorganization Plan No. 3 of 1950 – 64 Stat. 1262; November 8, 1993).

Treaties are negotiated contracts made pursuant to the Constitution of the United States and are considered the "supreme law of the land." They take precedence over any conflicting state laws because of the supremacy clause of the Constitution (United States Constitution, Art. VI, Clause 2). Treaty rights are not gifts or grants from the United States, but bargained-for concessions. These rights are grants-of-rights from the tribes, rather than to the tribes. The reciprocal obligations assumed by the federal government and American Indian Tribes constitute the chief source of present-day federal Indian law.

The United States and represented agencies, including the BLM, have a special trust relationship with American Indian Tribes because of these treaties. As a federal land management agency, the BLM has the responsibility to identify and consider potential impacts of BLM plans, projects, programs, or activities on Indian trust resources.

When planning any proposed project or action, the BLM must ensure that all anticipated effects to Indian trust resources are addressed in the planning, decision, and operational documents prepared for each project. The BLM also has the responsibility to ensure that meaningful consultation and coordination concerning tribal treaty rights and trust resources are conducted on a government-to-government basis with federally recognized tribes.

American Indians inhabited eastern Montana, including the lands now managed by the MCFO, for thousands of years prior to European contact. They hunted, fished, gathered plant foods, buried their dead, and conducted religious ceremonies on lands within the planning area since ancient times. Native groups historically utilized numerous areas in the planning area for natural resource foraging, hunting subsistence, habitation, and spiritual and religious ceremonies. Practices that continue today include visiting these areas for plant and mineral gathering; rock art, traditional camp, and ceremonial sites; and burial areas.

The lands managed by the MCFO are within the historical or traditional culture use area of the following tribes:

- Fort Peck Tribes (Assiniboine and Sioux),
- Lower Brule Sioux Tribe,
- Turtle Mountain Band of Chippewa Indians,
- Crow Tribe,
- Northern Cheyenne Tribe,
- Oglala Sioux Tribe of the Pine Ridge Reservation,
- Standing Rock Sioux Tribe of the Standing Rock Reservation,
- Rosebud Sioux Tribe,
- Northern Arapaho Tribe,
- Eastern Shoshone Tribe,
- Cheyenne River Sioux Tribe,
- Blackfeet Tribe,
- Gros Ventre and Assiniboine Tribes of the Fort Belknap Reservation, and
- Chippewa-Cree Tribe of the Rocky Boy’s Reservation.

The MCFO maintains a government-to-government relationship with tribal governments in the use and protection of cultural and natural resources on public lands. It is also the responsibility of federal agencies to consult with federally recognized tribes and other interested parties to ensure that their policies and actions do not unduly violate the traditional values of American Indian groups. The traditional value of primary concern to land managers is a respect for the land and places in which American Indian ancestors once lived.

ECONOMIC CONDITIONS

Key Industries in the Planning Area

Agriculture, mineral and energy development, and recreation and tourism are the industries in the planning area most affected by BLM management. More information on these industries follows.

Many livestock operators in the area graze livestock on public lands. In 2005, there were 544,564 AUMs available for livestock use in the planning area. The planning area contained 1,699 grazing allotments that covered 12,465,374 acres, of which 2,737,086 were BLM-administered acres (Table 3-40).

Agriculture is the second largest industry in the planning area (after the service industry) and provides 18 percent of the jobs. Agriculture has traditionally been an important industry in the planning area, and it continues to be important today. There were 7,346 farms in the area in 2007, totaling 25,757,000 acres (NASS 2007), which accounts for 25 percent of the farms and 42 percent of the land in farms in the state.

Agriculture

The total value of farm products sold in 2007 for the planning area was $964,974,000, 34 percent of the state total. The average value of farm products sold per farm in 2007 was $131,360. In 2007, 48 percent of the sales were from crops and 52 percent from poultry and livestock. This compares to a statewide average value of farm products sold per farm of $94,942 (45 percent crops and 55 percent livestock and poultry).

There were 114,370 sheep and lambs and 939,800 cattle and calves in the planning area in 2007, which represents 42 percent of the sheep and lambs and 36 percent of the cattle and calves in Montana (Table 3-41).

TABLE 3-40.
GRAZING ALLOTMENTS IN THE PLANNING AREA

County	Number of Allotments	Number of AUMs	Total Allotment Acreage	Acreage of Allotments on BLM-administered Lands
Big Horn	38	5,329	303,936	25,645
Carter	261	97,342	1,651,891	498,075
Custer	180	60,552	1,884,834	334,868
Daniels	1	20	1,572	38
Dawson	76	12,279	441,985	60,673
Fallon	154	26,556	631,043	113,227
Garfield	205	91,616	2,090,760	494,058
McCone	138	39,993	708,179	199,579
Powder River	220	52,773	1,302,400	253,976
Prairie	143	104,138	940,048	447,048
Richland	96	11,802	297,279	50,590
Roosevelt	13	1,262	33,502	3,624
Rosebud	139	35,045	1,960,745	227,906
Sheridan	3	50	2,587	140
Treasure	4	369	47,453	710
Wibaux	27	5,436	167,162	26,930
Total	**1,699**	**544,564**	**12,465,374**	**2,737,086**

Note: To prevent double counting (and to present values consistent with those in the grazing analysis), allotment and AUM numbers were treated proportionally.
Source: BLM 2005g

Mineral and Energy Development

At the planning area level, mining provides 3 percent of the jobs (United States Census Bureau 2000a). Many counties in the planning area that contain mineral resources have supported coal mining, conventional oil and gas, or CBNG development, including Big Horn, Carter, Dawson, Fallon, Powder River, Prairie, Richland, Rosebud, Treasure, Valley, and Wibaux counties (BLM 2003l). To analyze impacts from conventional oil and gas and CBNG development, BLM and the State of Montana prepared a joint EIS and RMP amendment. The planning area for that EIS and RMP amendment covered the entire state, with an emphasis on BLM's Billings and Powder River Resource Management Areas. For analysis purposes, workers living in Wyoming would likely fill most of the CBNG jobs created. There is a high level of regional interest in CBNG production, with most concerns focused on water-related impacts. Wind power is another type of energy technology under development in the planning area.

Counties receive a share of the federal revenues from the production of minerals on federal lands, the amount of which is based on the wellhead price of oil and gas and the free-on-board mine price for coal. In fiscal year 2010, the counties in the planning area received $10.3 million from coal, oil, and gas leasing and production, which was a 10 percent increase from fiscal year 2009, resulting from the rise in oil and gas prices in 2010 (Table 3-42).

Recreation and Tourism

Employment in recreation and tourism is reflected primarily in the services and retail trade sectors. Together, those industries account for 42 percent of the jobs in the planning area.

Public lands provide many recreational opportunities for local residents and visitors. There are 14 BLM-administered recreation sites in the planning area: Moorhead Recreation Site, Howrey Island Wildlife Viewing Area, Matthews Recreation Area, Powder River Depot, Strawberry Hill Recreation Area, Terry OHV Area, Glendive Short Pine OHV Area, Calypso Trail SRMA, Hay Draw TMA, Knowlton TMA, Lewis and Clark Trail SRMA, Pumpkin Creek Ranch and Recreation Area, Big Sky Back Country Byway, and Dean S. Reservoir (BLM 2010m). Recreation activities that do not occur at the developed sites are referred to as dispersed use. Dispersed use accounts for approximately 88 percent of the visitors.

**TABLE 3-41.
PLANNING AREA LIVESTOCK INVENTORY IN 2007**

County	Sheep and Lambs	Cattle and Calves
Big Horn	640	93,200
Carter	37,000	65,800
Custer	5,800	99,500
Daniels	350	18,700
Dawson	5,200	46,600
Fallon	2,300	49,200
Garfield	23,400	68,400
McCone	6,800	38,800
Powder River	14,700	77,100
Prairie	2,400	39,300
Richland	5,000	82,600
Roosevelt	3,200	35,600
Rosebud	3,000	78,600
Sheridan	1,700	23,200
Treasure	80	33,200
Valley	2,200	71,100
Wibaux	600	18,900
Planning Area Total	**114,370**	**939,800**
Montana Total	**272,000**	**2,590,000**
Planning Area, Percentage of MT (%)	**42**	**36**

**Notes: Data for Big Horn and Valley counties represent the entire counties, including areas of these counties that are outside of the planning area.
Numbers have been rounded.**

Based on interviews of local residents involved in the real estate industry, the Billings Gazette reported that people are buying land in eastern Montana for its recreational value (Thackeray 2005c). These buyers often look for land close to public lands to extend their recreational range. The article explained that these landowners reside in other states and only come out a couple times a year to hunt or engage in other recreational activities.

MFWP provides information on recreation in Montana and divides the state into seven regions. MFWP Region 7 includes most of the planning area, which is known for mule deer, antelope, upland game bird, and waterfowl hunting; fishing in ponds, reservoirs, and three major rivers; and wildlife viewing (MFWP 2005a). The region has six state parks, four wildlife management areas, and numerous fishing access sites. Survey results reported in the *Montana Statewide Comprehensive Outdoor Recreation Plan* stated that the primary outdoor recreation activities in MFWP's Region 7 were walking (25 percent), other activity (13 percent), none (10 percent), golf (9 percent), fishing (8 percent), hunting (6 percent), and horseback riding (5 percent) (MFWP 2008).

The BLM collects recreation data by recreational activity for each field office (Table 3-43). The number of visitor days was documented for 33 recreational activities for fiscal year 2005 through fiscal year 2009. (The activities were categorized as General Recreation or Fish and Wildlife-related Recreation for impact analysis in Chapter 4, *Environmental Consequences*.) Fish and wildlife-related activities, principally hunting and fishing, accounted for two-thirds of the visitor days. General recreation (mainly camping, driving for pleasure, OHV use, and picnicking) accounted for one-third of the total visitor days.

Government Revenues and Contribution

A source of local government revenue directly attributable to public lands in the counties is payment in lieu of taxes. The federal government makes these payments to compensate counties for lost property tax revenue resulting from the presence of public lands. There were 4.8 million acres of public lands in the planning area, of which 83 percent (3.66 million acres) were managed by BLM. The counties in the planning area received $2,776,506 in PILT payments in 2011 (Table 3-44). The payments are made based on population, receipt-sharing payments, and the amount of federal land in each county. The PILT payment for the BLM-administered lands in the planning area was $2,307,000.

Employment in the BLM MCFO contributes directly to the planning area economy. These employees reside in the area and spend dollars at local businesses. In 2009, the MCFO employed 105 permanent full-time staff and 56 other than permanent positions, including temporary and career seasonal employees.

TABLE 3-42.
FEDERAL MINERAL DISTRIBUTIONS TO COUNTIES IN THE PLANNING AREA

County	Fiscal Year 2007	Fiscal Year 2008
Big Horn	$2,995,904	$4,015,548
Carter	$65,846	$98,689
Custer	$22,722	$8,864
Daniels	$1,342	$1,310
Dawson	$294,625	$335,815
Fallon	$1,962,177	$2,472,271
Garfield	$5,664	$37,311
McCone	$451	$498
Powder River	$77,519	$165,664
Prairie	$79,265	$111,652
Richland	$238,399	$377,550
Roosevelt	$34,324	$20,907
Rosebud	$1,274,298	$1,345,430
Sheridan	$13,247	$14,652
Treasure	$139,853	$110,872
Valley	$89,562	$94,085
Wibaux	$332,773	$403,071
Planning Area Total	**$7,627,968**	**$9,614,189**

Note: Data for Big Horn and Valley counties represent the entire counties, including the areas outside of the planning area.

Eastern Montana Resource Advisory Council visit to Glendive Short Pine OHV area

Osprey nesting platform in the planning area

TABLE 3-43.
VISITOR DAYS IN THE PLANNING AREA BY ACTIVITY AND TYPE

Activity	Fiscal Years 2005 to 2009			Fiscal Year 2009		
	Visitor Days	General	Fish and Wildlife	Visitor Days	General	Fish and Wildlife
Archery	19,656	0	19,656	4,278	0	4,278
Bicycling, mountain	2,832	2,832	0	66	66	0
Camping	67,496	67,496	0	11,580	11,580	0
Driving for pleasure	19,629	19,629	0	4,650	4,650	0
Environmental education	323	323	0	107	107	0
Fishing, freshwater	12,314	0	12,314	2,165	0	2,165
Gathering, non-commercial	62	62			N/A	
Hiking, walking, or running	6,424	6,424	0	1,962	1,962	0
Horseback riding	1,772	1,772	0	13	13	0
Hunting, big game	193,173	0	193,173	45,022	0	45,022
Hunting, small game	1,268	0	1,268	169	0	169
Hunting, upland bird	37,483	0	37,483	13,298	0	13,298
Hunting, waterfowl	1,723	0	1,723	1,094	0	1,094
Interpretive programs	2,359	2,359	0	181	181	0
Nature study	7,088	7,088	0	1,814	1,814	0
OHV, ATV	6,980	6,980	0	1,846	1,846	0
OHV, cars, trucks, or SUVs	2,877	2,877	0	516	516	0
OHV, motorcycle	7,651	7,651	0	1,233	1,233	0
Photography	101	101	0	31	31	0
Picnicking	8,124	8,124	0	2,111	2,111	0
Power boating	64	64			N/A	
Racing, foot	33	33	0	33	33	0
Rockhounding or mineral collection	961	961	0	58	58	0
Row, float, or raft	1,690	1,690	0	84	84	0
Snowmobiling	749	749	0	62	62	0
Social gathering	364	364			N/A	
Target practice	5,328	5,328	0	735	735	0
Trapping	624		624	157	0	157
Viewing, cultural	81	81			N/A	
Viewing, other	2	2			N/A	
Viewing, scenery	1,700	1,700	0	1,565	1,565	0
Viewing, wildlife (50% general and 50% fish and wildlife)	20,497	10,249	10,249	12,069	6,035	6,035
Viewing, interpretive exhibit	121	121	0	24	24	0
Total	**431,549**	**155,060**	**276,490**	**106,923**	**34,706**	**72,218**
Percent of Total (%)		**35.9**	**64.1**		**32.5**	**67.5**

TABLE 3-44.
PAYMENTS IN LIEU OF TAXES FOR FISCAL YEAR 2011

County	Payment ($)	Percentage of Planning Area (%)
Big Horn	$13,659	0.5
Carter	$191,464	6.9
Custer	$781,125	28.1
Daniels	$0	0.0
Dawson	$21,085	0.8
Fallon	$38,207	1.4
Garfield	$186,092	6.7
McCone	$269,036	9.7
Powder River	$196,724	6.9
Prairie	$141,582	5.1
Richland	$17,869	0.6
Roosevelt	$1,413	0.1
Rosebud	$107,427	3.9
Sheridan	$587	0.0
Treasure	$247	0.0
Valley	$801,090	28.9
Wibaux	$8,899	0.3
Planning Area Total	$2,776,506	100.0

Source: National Business Center 2011
Notes: Data for Big Horn and Valley counties represent the entire counties, including the areas outside of the planning area.

HAZARDOUS MATERIALS AND WASTE

Hazardous materials represent a significant risk to public safety, human health, and the environment and are therefore important issues for BLM management (Table 3-45). Hazardous materials management also involves the prevention of illegal hazardous-material actions on BLM-administered lands; the regulation, authorization, and proper use of legal hazardous materials on BLM-administered lands; and timely, safe responses to hazardous materials incidents on BLM-administered lands.

Some illicit dumping occurs on BLM-administered lands in the planning area. Much of the illicit activity is intentional, small-quantity waste dumping that may include hazardous substances, household waste, petroleum products, solid waste, and agricultural materials. Illicit dumping may occur anywhere on BLM-administered lands, but is generally concentrated around recreation areas and along roadways. These dumping incidents may not fit the specific category of hazardous waste dumping, but the dumped materials are usually screened for hazardous components before the materials are removed and disposed of properly. Instances of significant or hazardous dumping in the planning area are limited, which is attributed to the relatively low population density around the BLM-administered lands.

The MCFO has responded to a number of vehicular accidents that involved the accidental release of hazardous materials or petroleum products from transport vehicles. The hazardous materials management program may become involved with a particular response action or cleanup when the release affects BLM-administered lands.

TABLE 3-45.
POTENTIAL HAZARDOUS ACTIVITIES AND EXPOSURE RISKS

Potential Hazardous Activity	Exposure Risk
Facilities on public land (under a ROW)	Leaky underground storage tanks; asbestos
Historic and active mining operations	Acid rock drainage; hazardous chemicals associated with ore processing (e.g., cyanide); explosives (e.g., dynamite, ammonium nitrate, caps, and boosters); heavy metals; asbestos
Illegal activities	Drug lab waste sites; wire burn sites
Illegal dumping of barrels or other containers containing hazardous substances	Unauthorized landfills
Military operations	Unexploded ordinance; aircraft wreckage
Oil and gas activities	Hydrogen sulfide gas; oil spills

In recent years, the BLM has responded to a number of dumped methamphetamine lab or related drug wastes. Methamphetamine drug lab wastes frequently include highly toxic chemicals, flammable materials, and potentially explosive materials, which present a hazard to wildlife and a direct health and safety hazard to individuals who may inadvertently encounter these materials. Potential skin punctures and disease transmission caused by discarded drug paraphernalia are also a concern.

Hazardous materials may be brought legitimately onto BLM-administered lands for invasive vegetation species (weed) control or resource development. The types of hazardous materials used for weed and insect control include pesticides (herbicides and insecticides). The general types of hazardous materials that may be used include petroleum products (fuels and lubricants), solvents, surfactants, paints, explosives, batteries, acids, gases, antifreeze, and mineral products (mine waste, cement, and drilling materials). Another source of hazardous materials is from actions involving ROWs, leases, and permits. Examples of these types of actions are on-site storage and use of fuels (oil and gas), telecommunication sites, and transportation facilities.

Greater short-horned lizard at the Glendive Short Pine OHV Area

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