Chapter 3
Affected Environment

Chapter 3 contains a description of the physical, biological, cultural, economic and social conditions of the South Dakota Field Office (SDFO) planning area. The Affected Environment serves as the baseline of existing conditions from which the impacts of the alternatives may be analyzed in the Resource Management Plan (RMP).

Natural, Biological, and Cultural Resources

Air Resources

Regional air resources are influenced by the interaction of several factors, including weather, climate, the magnitude and spatial distribution of local and regional air pollutant sources, and the chemical properties of emitted air pollutants. Air resources include air quality and air quality related values (AQRVs), which include visibility and acid deposition to soils and lakes.

The regulation of air quality standards, emission controls, and other requirements are primarily the responsibility of the Environmental Protection Agency (USEPA) and the South Dakota Department of Environment and Natural Resources (SD DENR). The BLM works cooperatively with these regulatory agencies and other federal land management agencies to maintain compliance with air quality standards in the planning area.

Regional Winds

Wind is a critical component of ambient air quality because it disperses pollutants and transports them away from the point of origin. The prevailing wind directions for Rapid City, South Dakota are out of the north and north-northwest, as shown in Table 3-1.

Table 3-1
Prevailing Wind Directions and Average Speeds (mph) for Rapid City, South Dakota

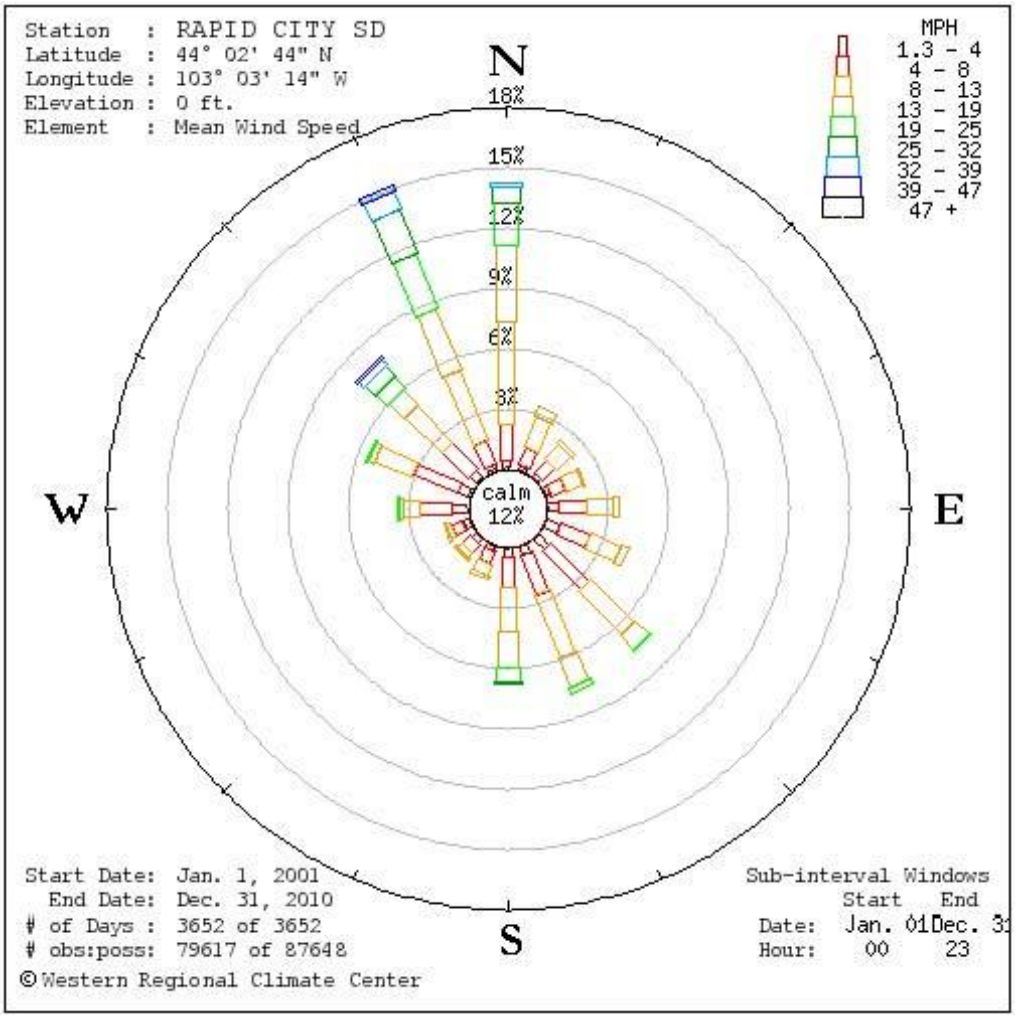
JAN	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEPT*	*OCT*	*NOV*	*DEC*	*Annual*
NNW	N	N	N	N	N	N	N	NNW	NNW	N	N	N
11.8	12.0	12.9	13.5	12.8	11.6	11.0	10.4	10.7	11.0	11.0	11.0	11.7

Source: WebMet 2011. Data processed using Lakes Environmental WRPLOT View Freeware, version 7.0.0.

A wind rose for the Rapid City, South Dakota weather station indicates wind speed frequencies and wind directions. The 16 arms in Figure 3-1 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.

Sagebrush/Grassland in Harding County, SD BLM Photo

Figure 3-1
Wind Rose for Rapid City, South Dakota (2001-2010)



Source: WRCC 2012.

Criteria Air Pollutants

Criteria air pollutants are substances for which the USEPA established national health-based concentration standards under the National Ambient Air Quality Standards (NAAQS) program. Criteria air pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter with a diameter greater than or equal to 10 micrometers (PM_{10}), particulate matter with a diameter greater than or equal to 2.5 micrometers ($PM_{2.5}$), and sulfur dioxide (SO_2). Criteria air pollutant concentrations are compared to NAAQS and South Dakota Ambient Air Quality Standards (SDAAQS), which are equivalent to the NAAQS. The standards include primary and secondary standards, as shown in Table 3-2. 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 soils, water, crops, vegetation, buildings, property, animals, wildlife, weather, visibility, and other economic, aesthetic, and ecological values.

Areas that do not meet federal standards are designated as nonattainment areas. Air quality within the planning area is good and all areas are designated as attainment areas that meet the NAAQS or as unclassifiable areas that are presumed to meet the NAAQS. South Dakota is one of only a few states that comply with NAAQS statewide.

Table 3-2
Federal and State Ambient Air Quality Standards

Pollutant	*NAAQS and SDAAQS*[1]		
	Averaging Time	*Level*	*Standard Type*
Carbon Monoxide (CO)	8-hour	9 ppm[2]	Primary
	1-hour	35 ppm[2]	Primary
Lead (Pb)	3-month (rolling)	0.15 µg/m^3 [3]	Primary, Secondary
Nitrogen Dioxide (NO_2)	Annual	0.053 ppm[3]	Primary, Secondary
	1-hour	0.100 ppm[8]	Primary
Fine Particulate Matter ($PM_{2.5}$)	Annual	12.0 µg/m^3 [9], 15.0 µg/m^3	Primary, Secondary
	24 hour	35 µg/m^3 [5]	Primary, Secondary
Particulate Matter (PM_{10})	24-hour	150 µg/m^3 [6]	Primary, Secondary
Ozone (O_3)	8-hour	0.075 ppm[4]	Primary, Secondary
Sulfur Dioxide (SO_2)	3-hour	0.5 ppm[2]	Secondary
	1-hour	0.075 ppm[7]	Primary

[1] NAAQS are codified in Title 40 of the Code of Federal Regulations (CFR), Part 50. South Dakota state standards are no more stringent that federal standards.
[2] Not to be exceeded more than once per calendar year.
[3] Not to be exceeded.
[4] Based on the 3-year average of the fourth-highest daily maximum 8-hour concentrations per calendar year.
[5] Based on the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor.
[6] Not to be exceeded more than once per calendar year, based on a 3-year average of maximum 24-hour values.
[7] Based on a 3-year average of the 99th percentile of the daily maximum concentrations.
[8] Based on a 3-year average of the 98th percentile of the daily maximum concentrations.
[9] Based on a 3-year average of the weighted annual mean from one or more community monitors.

Air Quality Monitoring

SD DENR performs regulatory monitoring of CO, NO_2, ozone, SO_2, PM_{10}, and $PM_{2.5}$ in order to determine compliance with NAAQS. Air pollutant concentration monitoring networks in western South Dakota include the State and Local Air Monitoring Stations (SLAMS) and the Clean Air Status and Trends Network (CASTNet). SLAMS are usually located in urban areas and measure criteria pollutants. The DENR operates the SLAMS network to determine compliance with regulatory concentration standards. CASTNet stations are located in remote areas and measure concentrations of compounds that are of interest to ecosystem health. Air pollutant concentrations are usually reported on a volume basis as parts per million (ppm) or parts per billion (ppb) for gaseous substances and on a mass basis as micrograms per cubic meter (µg/m^3) for solid substances such as PM_{10} and $PM_{2.5}$.

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

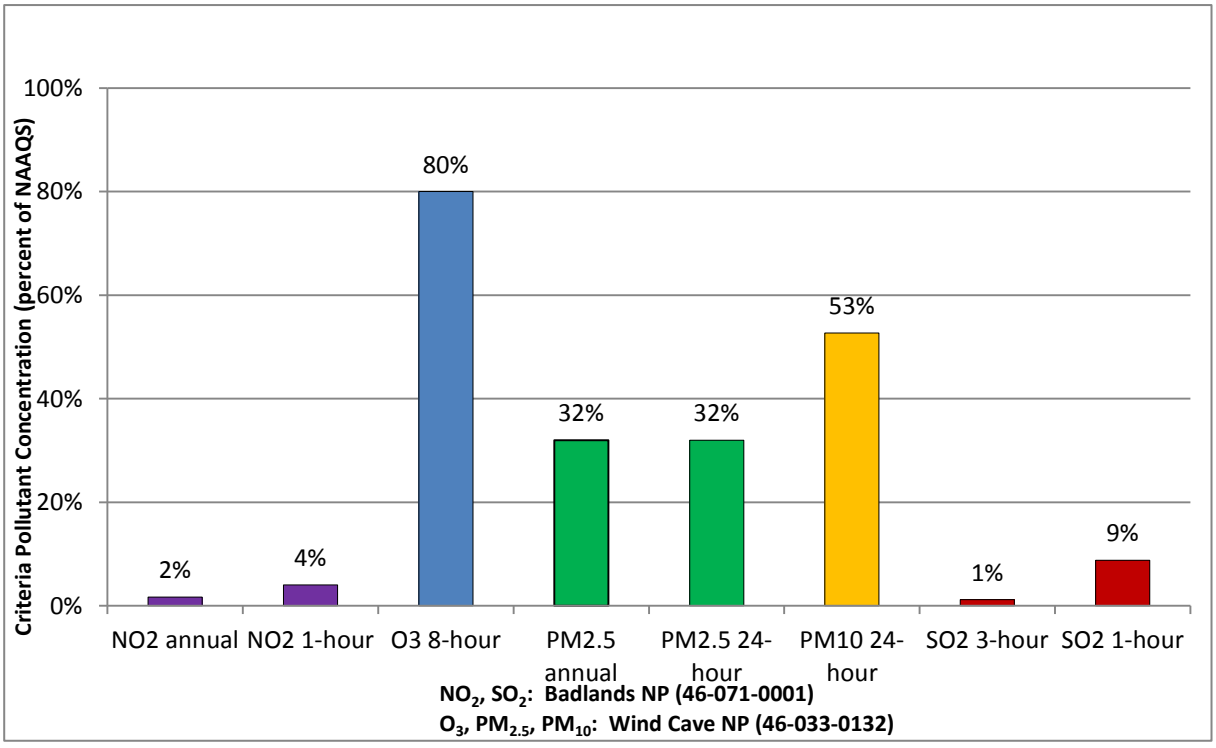
The sources and effects of each criteria pollutant are explained below. Recent ambient air quality monitoring data are shown as the percentage of the monitored concentration compared to the NAAQS in Figure 3-2. Values shown in Figure 3-2 are based on the format of the NAAQS. For example, when a NAAQS allows one exceedance of a standard per year, the second highest monitored value is reported for comparison to the NAAQS. In many cases, the NAAQS format requires multi-year averages for some criteria pollutants. When the nearest monitor has fewer years of data than required by the NAAQS format, no data is reported for that monitor.

Table 3-3
Air Quality Monitoring Stations In or Near the Planning Area

Monitoring System	*Station Identifier*	*Pollutant or AQRV*	*Location*	*Latitude*	*Longitude*
SLAMS	46-103-0013	O_3, PM_{10}, $PM_{2.5}$	Rapid City National Guard	44.0835	-103.2696
	46-103-0020	NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2	Rapid City Credit Union	44.08740	-103.2738
	46-103-1001	PM_{10}, $PM_{2.5}$	Rapid City Library	44.0803	-103.2285
	46-093-0001	O_3, PM_{10}, $PM_{2.5}$	Black Hawk Elementary	44.1556	-103.3158
	46-071-0001	NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$, SO_2	Badlands NP	43.7456	-101.9412
	46-033-0132	NO_2, NO_x, O_3, PM_{10}, $PM_{2.5}$, SO_2	Wind Cave NP	43.5578	-103.4839
CASTNET	THR422	O_3, SO_2, Deposition	Theodore Roosevelt NP (North Dakota)	46.8947	-103.3778
	WNC429	O_3, SO_2, Deposition	Wind Cave NP	43.5578	-103.4839
NADP	SD08	Wet Deposition	Cottonwood (Jackson Co.)	43.9461	-101.8552
	SD04	Wet Deposition	Wind Cave NP	43.5577	-103.484
IMPROVE	BADL1	Visibility	Badlands NP	43.743	-101.941
	WICA1	Visibility	Wind Cave NP	43.558	-103.484

Source: USEPA 2012d.

Figure 3-2
Ambient Air Quality Concentrations in the South Dakota Planning Area (2009-2011)



Source: SD DENR 2012a.

NO_2 1-hour: 3-year average of 98th percentile (2009-2011)
Annual: arithmetic mean (2011)

O_3 3-year average of 4th highest daily maximum 8-hour average (2009-2011)

$PM_{2.5}$ 24-hour: 3-year average of 98th percentile (2009-2011)
Annual: 3-year average weighted mean (2009-2011), based on standard effective at that time

PM_{10} 24-hour: 3-year average of 2nd maximum (2009-2011)

SO_2 1-hour: 3-year average of the 99th percentile of 1-hour daily maximum concentrations (2009-2011)
3-hour: Second maximum (2011)

Carbon Monoxide

CO 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 CO concentrations can include slight headaches, nausea, or death.

Motor vehicles and other internal combustion engines are the dominant source of CO emissions in most areas. High CO 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. CO is also created during refuse, agricultural, and wood-stove burning and through some industrial processes.

CO monitors are currently located only in eastern South Dakota. Based on 2011 monitoring data, SD DENR characterized CO concentrations as very low at the eastern monitoring location (SD DENR 2012a). Though not monitored in or near the planning area, CO concentrations are expected to be well below the NAAQS due to the low levels of industrial activity and vehicular traffic in the area.

Lead

The primary historical sources of lead emissions have been certain types of industrial sources and lead in gasoline and diesel fuel. However, since lead in fuels has decreased substantially, 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. Due to the lack of large lead emission sources, lead levels in the planning area are expected to be well below the NAAQS. 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

Nitrogen oxides (NO_x), including nitric oxide (NO) and NO_2, 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, NO_2 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, NO_2 contributes to visibility impacts and may be visible as reddish-brown haze. NO_2 and other forms of NO_x form nitric acid (HNO_3), a component of atmospheric deposition (e.g., acid rain.).

Atmospheric Deposition

The transfer of substances in air to surfaces, including soil, vegetation, surface water, or indoor surfaces, by dry or wet processes.

Source: http://glossary.eea.europa.eu/EEAGlossary/D/deposition

Hourly NO_2 concentrations from the Badlands National Park (NP) monitor within Pennington County are provided in Figure 3-2. Monitored average annual concentrations were 2 percent of the NAAQS during 2011, while 1-hour concentrations (3-year average of the 98th percentile) were 4 percent of the NAAQS.

Ozone

Ozone is not emitted directly into the atmosphere. Instead, it is formed by a photochemical reaction of precursor air pollutants, including volatile organic compounds (VOCs) and NO_x. These precursors are emitted by mobile sources, stationary combustion equipment, and other industrial sources. Ozone is produced year-round, but due to greater sunlight and air temperatures, urban ozone concentrations are generally greatest during the summer. Elevated ozone concentrations may also occur during winter in snow-covered rural areas, particularly in areas with deep valleys.

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 3-year average of the fourth highest 8-hour ozone concentration was 0.060 ppm at Wind Cave NP (Custer County) during 2009-2011. This measured concentration is 80 percent of the 8-hour 2008 primary and secondary NAAQS of 0.075 ppm. Ozone monitors at nearby locations measured slightly lower ozone concentrations of 0.057 ppm and 0.055 ppm at the Blackhawk Elementary (near Rapid City) and Badlands NP sites, respectively.

Particulate Matter

Particulate matter includes PM_{10} and $PM_{2.5}$. 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. 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 PM_{10} include smoke from wildland fire, residential wood burning, street sand, physically disturbed soils, and dust from unpaved roads.

$PM_{2.5}$ poses greater health concerns than PM_{10} because $PM_{2.5}$ can be trapped deep in the lungs. Fine particulate also contributes to reduced visibility in nationally important areas such as national parks and wilderness areas. $PM_{2.5}$ 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.

Particulate Matter

Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

(PM_{10} is used to describe particles of 10 micrometers or less and $PM_{2.5}$ represents particles less than 2.5 micrometers). http://www.epa.gov/pm/

The second highest 24-hour PM_{10} concentration at the Wind Cave NP monitor was 79 $\mu g/m^3$ or 53 percent of the corresponding primary and secondary NAAQS. The 3-year average 98th percentile 24-hour $PM_{2.5}$ concentration at the same location and year was 11.2 $\mu g/m^3$, which was 32 percent of the corresponding primary and secondary NAAQS. The 3-year average weighted mean $PM_{2.5}$ annual concentrations at the same location and year was 4.80 $\mu g/m^3$, or approximately 32 percent of the corresponding primary and secondary NAAQS effective at that time.

Sulfur Dioxide

SO_2 is a colorless gas with a pungent odor. Prolonged exposure to high levels of SO_2 can lead to respiratory failure, and SO_2 plays an important role in the aggravation of chronic respiratory illnesses such as asthma. SO_2 is emitted primarily from stationary sources that burn fossil fuels (i.e., coal and oil) containing trace amounts of elemental sulfur. Other human-caused sources of SO_2 include metal smelters and petroleum refineries. In the atmosphere, SO_2 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 3-year average 99th percentile 1-hour SO_2 concentration was 6.6 ppb at the Badlands NP monitor in 2009-2011, which was 9 percent of the corresponding primary 75 ppb NAAQS. The second highest 3-hour (secondary standard) SO_2 value measured at the same site during 2011 was 6.0 ppb (1 percent) of the NAAQS.

VOCs

VOCs include a variety of chemicals, some of which have adverse health effects. Concentrations of many VOCs are consistently higher indoors than outdoors. VOCs are emitted from equipment such as organic liquid storage tanks, leaking equipment, and from engines and other combustion equipment. In addition, thousands of products emit VOCs, including paints, cleaning supplies, pesticides, building materials, office equipment, glues, and permanent markers. VOCs are not subject to a NAAQS. However, since they react with NO_x to form ground-level ozone, VOCs are a precursor to ozone and VOC emissions are regulated by USEPA.

Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are pollutants that are known or suspected to cause cancer or other serious health problems, which include chronic respiratory disease, reproductive disorders, or birth defects. Of the 187 regulated HAPs, several are commonly emitted from planning area engines and other sources. Engine-emitted HAPs include formaldehyde, benzene, toluene, ethyl benzene, xylenes, and hexane (i.e., n-hexane).

Other Pollutants

Other air pollutants of interest include nitrogen and sulfur compounds because they contribute to acid deposition and regional haze. Nitrogen compounds include particulate nitrate (NO_3^-), nitric acid, and ammonium (NH_4^+), while sulfur compounds include particulate sulfate (SO_4^{-2}) and SO_2. Concentrations of HNO_3, SO_2, NH_4^+, NO_3^-, and SO_4^{-2} within the planning area are low relative to concentrations across the United States (NADP 2011).

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 planning area based on a compilation of available emission inventory sources by USEPA as part of the 2008 National Emission Inventory (NEI). The counties included in the following table include nearly 99 percent of BLM-administered lands. Although the NEI does not capture all emissions in these counties, it is a reasonably good estimate of criteria pollutant emissions. Emissions of greenhouse gases (GHGs) are not included in Table 3-4 because these emissions were not reported to USEPA and the SD DENR for calendar year 2008.

Table 3-4
Planning Area Criteria Pollutant Emissions By County [1]

	Emissions (tons/year)					
County	***CO***	***NO_X***	***PM_{10}***	***$PM_{2.5}$***	***VOC***	***SO_2***
Butte	1,796	359	798	123	363	7
Custer	2,578	547	1,338	188	576	8
Fall River	1,450	1,950	702	145	356	25
Haakon	946	258	535	78	248	5
Harding	619	98	355	48	202	2
Lawrence	5,846	707	2,465	348	1,088	10
Meade	6,341	1,041	2,641	366	1,265	17
Pennington	24,474	3,044	5,168	843	4,362	47
Perkins	1,152	271	791	106	254	7
Stanley	971	210	534	74	321	4
Total	**46,173**	**8,485**	**15,327**	**2,319**	**9,035**	**132**

Source: USEPA 2012a.
[1] Approximately 99 percent of BLM-administered lands are located in Butte, Custer, Fall River, Haakon, Harding, Lawrence, Meade, Pennington, Perkins, and Stanley Counties.

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 US Forest Service (USFS), National Park Service (NPS), and US Fish and Wildlife Service (USFWS). 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 summarizes Class I and potential sensitive Class II areas in or near the planning area. Class I areas include Wind Cave National Park (NP) and the Badlands Wilderness. The seven potential sensitive Class II areas include two Indian reservations, a national memorial, a national monument, a small wilderness area, and two National Wildlife Refuges (NWRs). Sensitive Class II areas will be identified in the final RMP/EIS, based on information provided by the relevant agencies. Figure 3-3 shows the location of the Wind Cave NP and Badlands Wilderness Class I areas.

Table 3-5
Class I and Potential Sensitive Class II Areas In or Near the Planning Area

Area Name	Jurisdictional Agency
Class I Areas	
Wind Cave NP	NPS
Badlands Wilderness	USFS
Sensitive Class II Areas	
Standing Rock Indian Reservation	Tribal
Cheyenne River Indian Reservation	Tribal
Mount Rushmore National Memorial[1]	NPS
Jewel Cave National Monument[1]	NPS
Black Elk Wilderness[1]	USFS
Devil's Tower National Monument	NPS
Bear Butte NWR[1]	USFWS
Lacreek NWR[1]	USFWS

Source: USEPA 2012b.
[1] These areas may be determined to be sensitive Class II areas pending determinations made by the NPS, USFS, and USFWS.

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.

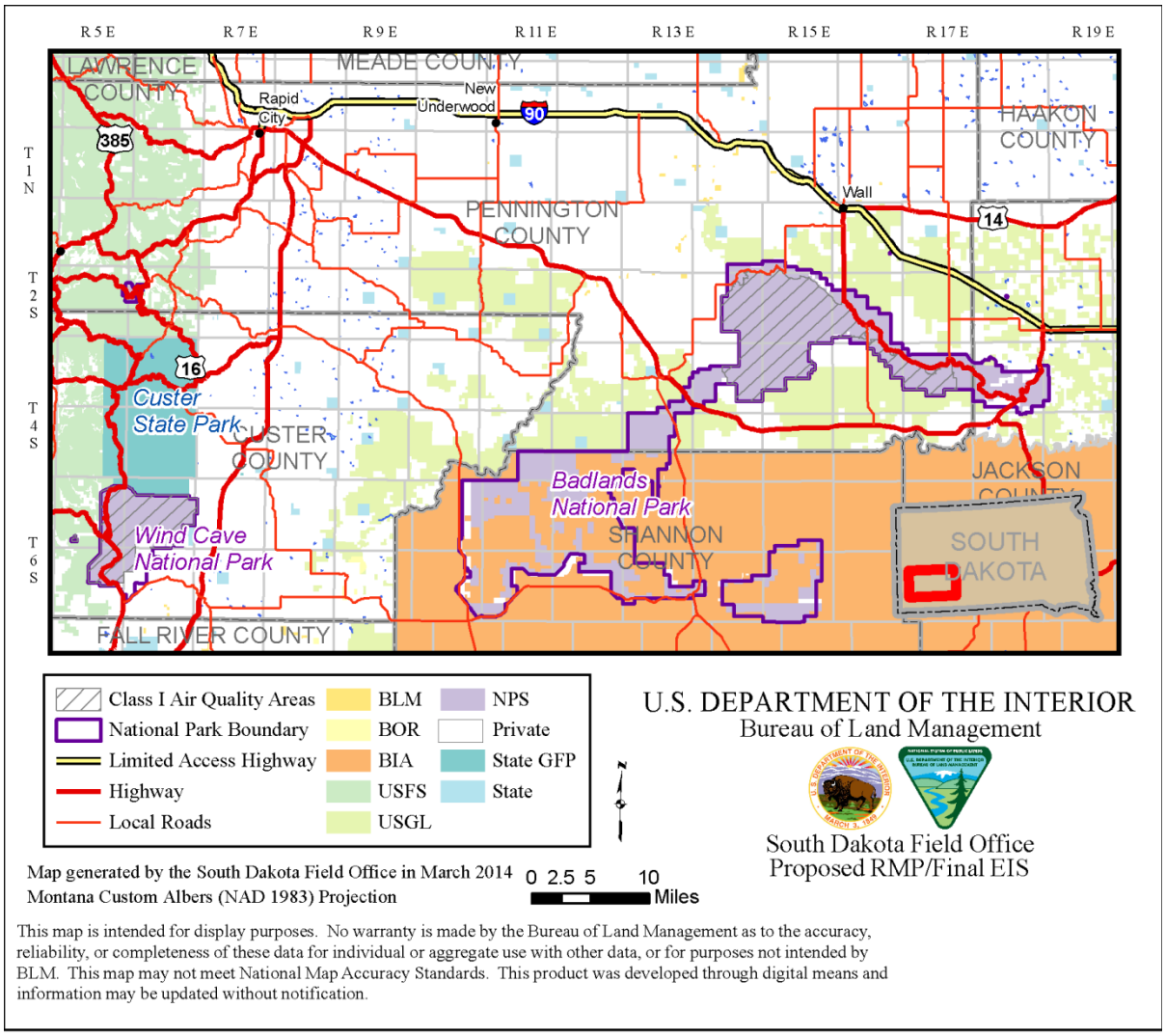
The normal range of precipitation pH is 5.0–5.6 (Seinfeld 1986). At the Wind Cave NP and Badlands NP stations, 2010 annual average precipitation pH was approximately 5.8 (NADP 2011). The planning area has low nitrate wet deposition (3–5 kilograms per hectare [kg/ha]) and ammonium wet deposition (2.4–3.0) compared to the rest of the United States, which has nitrate deposition values from 1–12 kg/ha and ammonium deposition values of 0.2–7.1 kg/ha (NADP 2011).

Total nitrogen deposition at the Wind Cave NP station was 3.48 kg/ha-yr in 2009 (CASTNet 2012). The planning area has moderate nitrate and ammonium deposition compared to the rest of the United States (NADP 2011b). With regard to total sulfur deposition, approximately 1.24 kg/ha-yr of sulfate was deposited at Wind Cave NP during 2009, which is low compared to most of the United States (CASTNet 2012).

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, lakes with acid neutralizing capacity values of between 10 to 25 µeq/L are considered to be very sensitive, and lakes with acid neutralizing capacity values of less than 10 are considered to be extremely sensitive (Fox 1989).

Figure 3-3
Class I Air Quality Areas



Visibility

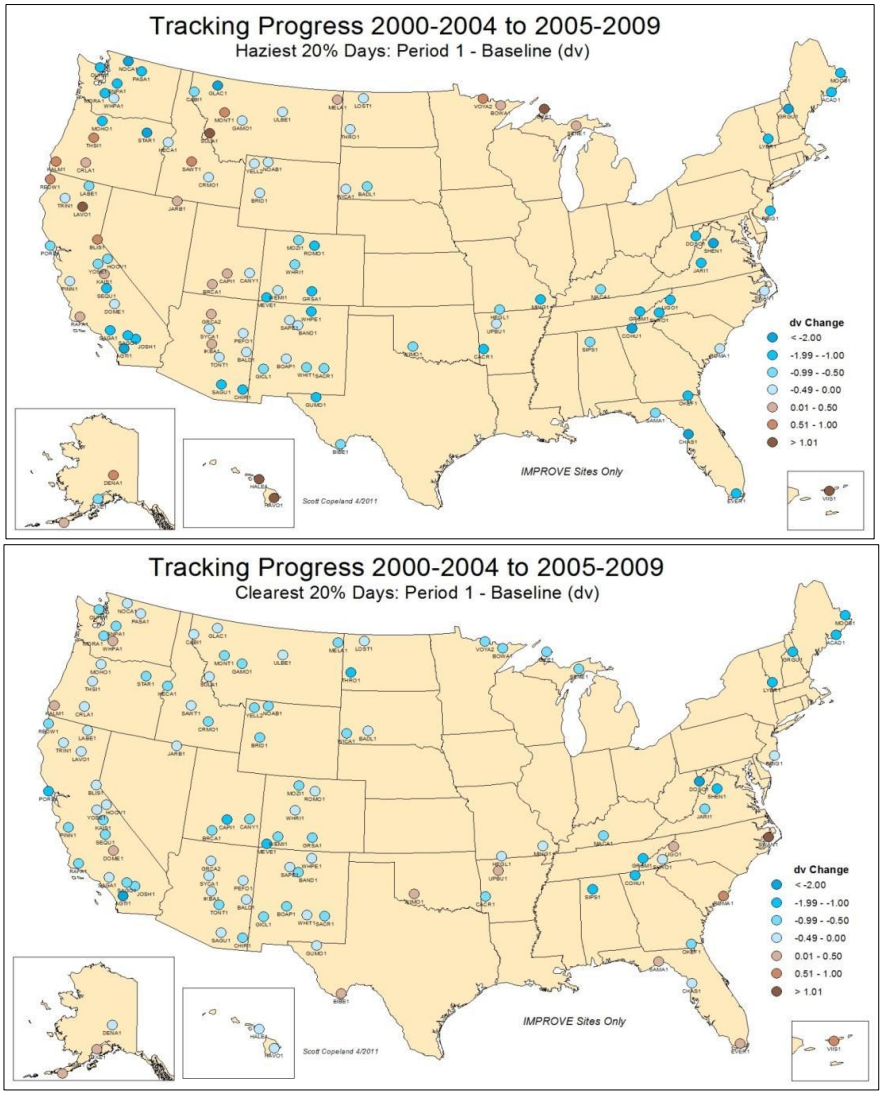
Visibility is a measure of how far and how well an observer can see a distant and varied scene. Pollutant particles in the atmosphere can impair scenic views, degrading the contrast, colors and distance an observer is able to see. Light extinction is used as a measure of visibility and is calculated 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 approximately a 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 (SVR), which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon; the larger the SVR, the cleaner the air. Since 1980, the Interagency Monitoring of Protected Visual Environments (IMPROVE) network has measured visibility in national parks and wilderness areas.

The average standard visual range at the Badlands NP IMPROVE monitor during 2008–2010 was 50 miles during the average haziest 20 percent of days and 132 miles during the clearest 20 percent of days (IMPROVE 2012). Similar standard visual range data are 59 and 160 miles at Wind Cave NP.

Visibility trends at Class I areas in or near the planning area are shown in Figure 3-4, based on data comparing the years 2000–2004 to the years 2005–2009. On the 20 percent worst visibility days, visibility improved moderately at Badlands NP and at Wind Cave NP. When the 20 percent best visibility days are considered, visibility improved slightly at Badlands NP and moderately at Wind Cave NP.

Figure 3-4
Visibility Trends on Haziest and Clearest Visibility Days (2005-2009)



Source: IMPROVE 2011.

Smoke Management

Smoke contains large quantities of CO and particulate matter. Potential air quality impacts to nearby populations and to nearby Class I areas (if applicable) are assessed by BLM prior to initiating prescribed burning. The size of the prescribed burn and predicted wind speed and wind direction are reviewed to assure good smoke dispersal. The SD DENR does not require BLM to obtain permits prior to prescribed burning.

Climate

Climate within the planning area is characterized by the climate of western South Dakota. This area has a continental climate with four distinct seasons. Summers are warm with generally low humidity. The average high summer temperature is approximately 85°F, although it generally cools down to approximately 60°F at night. However, it is not unusual to have severe hot, dry spells in the summer with the temperature climbing above 100°F several times every year. Winters are cold, with January high temperatures of approximately 32°F or below and low temperatures averaging between 3 and 10°F in most of the state. A climate summary for Rapid City, South Dakota is presented in Table 3-6 and a plot of average annual temperatures throughout South Dakota is provided in Figure 3-5.

Average annual precipitation generally increases from west to east and from lower elevations to higher elevations. The northwestern part of the planning area receives less than 17 inches annually while the southern and eastern extents of the planning area receive more. The area of highest precipitation is located near Lead in the Black Hills with more than 27 inches per year at high elevations. Figure 3-6 shows annual precipitation averages across the state from 1971 through 2000. Precipitation can vary considerably from year to year, and it is not unusual to experience prolonged droughts. Summers bring thunderstorms which can be severe with high winds, thunder, and hail. Tornadoes can occur in the planning area, though they are more common in the eastern portion of the state. Winters are somewhat more stable, although severe weather in the form of blizzards and ice storms can occur during the season.

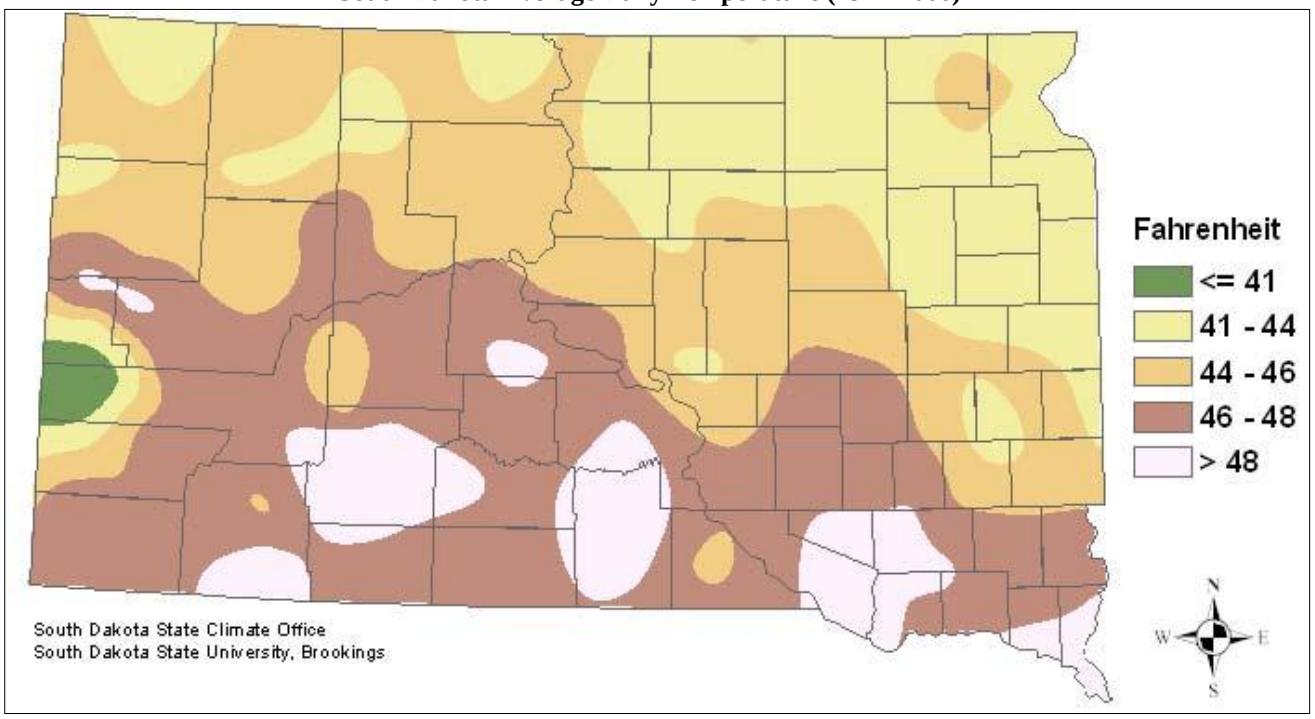
Table 3-6
Monthly Climate Summary for Rapid City, South Dakota

Period of Record: 5/1/1916 to 12/31/2010

	Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***July***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***	***Annual***
Average Max. Temperature (F)	36.4	40.4	46.2	56.7	67.2	77.3	85.5	84.9	74.9	62.9	47.9	39.4	60.0
Average Min. Temperature (F)	12.6	16.7	22.7	32.6	43.4	53.0	59.1	57.3	47.0	36.8	24.7	16.1	35.2
Average Total Precipitation (in.)	0.35	0.46	0.96	2.11	3.44	3.17	2.43	1.92	1.28	1.12	0.49	0.33	18.05
Average Total Snow Fall (in.)	4.6	5.6	8.7	6.5	0.9	0.1	0.0	0.0	0.1	1.3	4.3	4.1	36.
Average Snow Depth (in.)	1	1	1	0	0	0	0	0	0	0	0	1	0

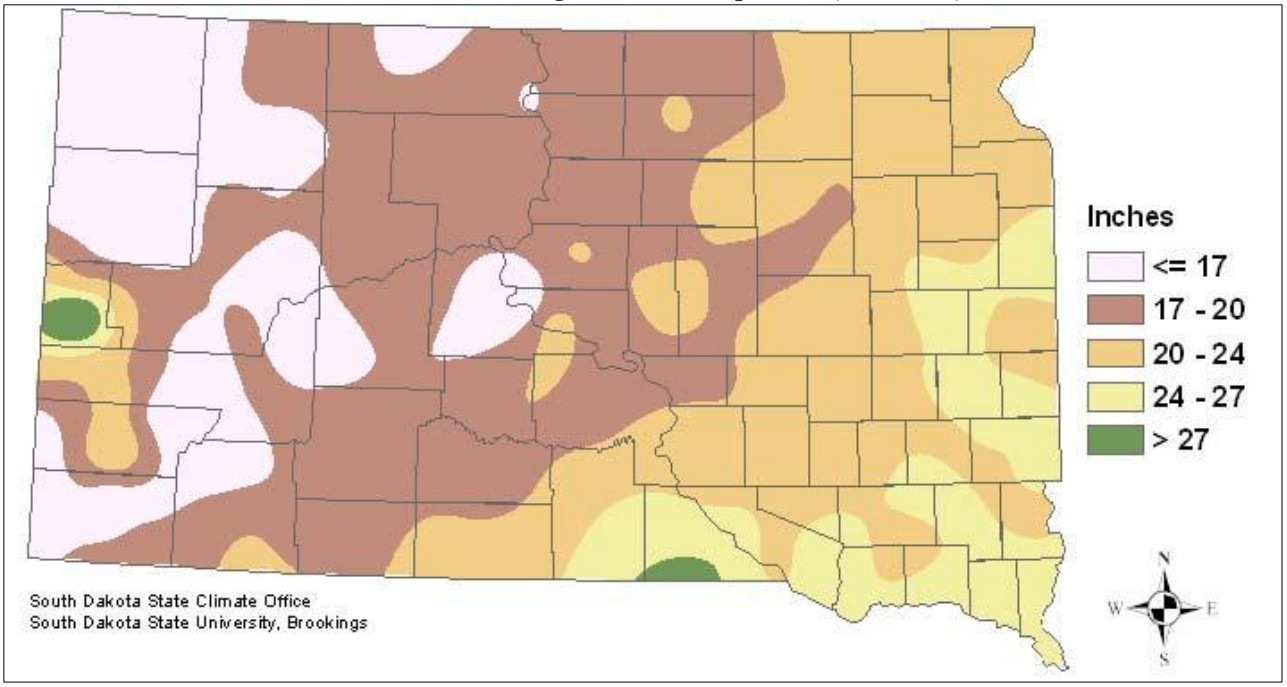
Source: High Plains Regional Climate Center (HPRCC 2012).

Figure 3-5
South Dakota Average Daily Temperature (1971-2000)



Source: SDSU 2012a.

Figure 3-6
South Dakota Average Annual Precipitation (1971-2000)



Source: SDSU 2012b.

The growing season (period between the last plant-killing frost in spring and the first plant-killing frost in fall) increases from less than 120 days in the northwest to 150 days in the southeast. In the valleys of the Black Hills, the growing season totals as little as 101 days. The last killing frost in the Black Hills occurs as late as June; elsewhere in the planning area it occurs in mid-May. The first killing frost in fall occurs in August or early September in the Black Hills and in late September elsewhere.

Climate Change

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 snow pack levels, stream flow volume and timing, and solar radiation.

The Intergovernmental Panel on Climate Change (IPCC) concluded "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very *likely* due to the observed increase in anthropogenic greenhouse gas concentrations." Chapter 9 of Working Group I of the 2007 IPCC Report (IPCC 2007) addressed the causes of climate change. Some of the conclusions included: 1) human-induced warming of the climate system is widespread, 2) "it is *likely*" that there has been a substantial anthropogenic contribution to surface temperature increases since the mid-20th century, and 3) 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 because they are based on well-known physical laws and document trends (USEPA 2012d).

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, 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 GHG emissions 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. This warming is associated with climatic variability that exceeds the historic norm and 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* (BLM 2010), IPCC Fourth Assessment (IPCC 2007), *Climate Change Indicators in the United States* (USEPA 2010b), and *Global Climate Change Impacts in the United States* (USGCRP 2009).

Carbon Dioxide

Carbon dioxide (CO_2) is emitted in a number of ways. It is emitted naturally through the carbon cycle and through human activities like the burning of fossil fuels. Natural sources of CO_2 occur within the carbon cycle where billions of tons of atmospheric CO_2 are removed from the atmosphere by oceans and growing plants, also known as 'sinks,' and are emitted back into the atmosphere annually through natural processes also known as 'sources.' When in balance, the total carbon dioxide emissions and removals from the entire carbon cycle are roughly equal. (http://www.epa.gov/climatechange/emissions/co2.html)

Greenhouse Gas

A greenhouse gas (GHG) is any of the atmospheric gases that contribute to the greenhouse effect by absorbing infrared radiation produced by solar warming of the Earth's surface. They include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), and water vapor. Although greenhouse gases occur naturally in the atmosphere, the elevated levels especially of carbon dioxide and methane have been observed in recent decades. These are directly related, at least in part, to human activities such as the burning of fossil fuels and the deforestation of tropical forests (http://www.thefreedictionary.com).

Annual GHG emissions for South Dakota, the United States, and the world are summarized in Table 3-7. Annual emissions of GHGs are usually quantified in units of metric tons (mt). A metric ton is equivalent to approximately 2,205 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 (GWP) number that takes into account each gas' atmospheric longevity and its heat-trapping capability. The GWP of CO_2 is set at 1. In USEPA regulations effective as of November 1, 2013, global warming potentials for methane and nitrous oxide are 21 and 310, respectively. The USEPA proposed to revised these global warming potentials to 25 (methane) and 298 (nitrous oxide). CO_2e emissions given in this document are based on global warming potential values of 21 and 310 because data referenced for comparison purposes are based on these values.

Other organizations, such as the IPCC, have set slightly different GWPs and these vary depending on the time frame being analyzed. For example, estimates of methane's global warming potential over a 20-year period range from 72 to 105. The BLM uses the methane global warming potentials that are specified in EPA regulations and are used for GHG emission reporting under 40 Code of Federal Regulations Part 98 as of November 1, 2013. This approach allows for consistent comparisons with state and national GHG emission inventories. The BLM also provides estimated methane and nitrous oxide emission quantities in Chapter 4, which allow the public to use other global warming potentials to calculate CO_2e, if desired.

GHG emission sources within the planning area 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 off-highway vehicles), livestock grazing, facilities development, and other equipment exhaust and fugitive emissions. 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 3-7
Estimated Annual GHG Emissions [1]

Entity	*Data Year*	*CO_2e Emissions (10^6 mt)*
South Dakota [2]	2007	31.6
United States [3]	2011	6,702
Global [4]	2004	49,000

[1] Emissions exclude GHG emissions and sequestration due to land use and land use changes.
[2] World Resources Institute Climate Analysis Tool (WRI 2012).
[3] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 (EPA 2013a).
[4] Climate Change 2007: Synthesis Report (IPCC 2007).

Global atmospheric concentrations of GHGs are determined by the quantity of GHGs emitted to and removed from the atmosphere. Global concentrations of CO_2, methane, and N_2O in 2009 were 387 parts per million (ppm), 1,744 parts per billion (ppb), and 323 ppb, respectively (EPA 2012c). More recently, the CO_2 concentration monitored at the Mauna Loa Observatory in Hawaii surpassed 400 ppm in May 2013. Atmospheric concentrations of CO_2 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 CO_2 (e.g., prescribed burns) or it can provide a sink of CO_2 through vegetation growth. The net storage or loss of carbon on rangelands and grasslands in western South Dakota is generally small and difficult to estimate or measure. Most soils within the area contain relatively little organic matter compared to forest soils.

Carbon Sequestration

Carbon Sequestration occurs when carbon dioxide CO_2 is removed from the atmosphere and stored in soils, biomass, and harvested products and protected or preserved to avoid CO_2 release back to the atmosphere. These become carbon stores or sinks. (US Dept. of Energy 2010)

Climate Change 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 emissions 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 2010). In addition, the long lifetimes of many GHGs contribute to committed climate change. For example, CO_2 typically remains in the atmosphere for 50–200 years, depending on how long it takes CO_2 molecules to be absorbed by plants, land, or the ocean. N_2O 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 2010). Additional types of GHGs also contribute to climate change, but their impact is substantially less due to their relatively small concentrations in the atmosphere.

Temperature and Precipitation

In the region, data from 1941 through 2005 indicate a long-term temperature increase between 0.40–0.80 °F per decade since 1976, as shown in Figure 3-7. With regard to precipitation, data from 1931 through 2005 indicate little change of up to a 0.6 to more than 1.0 inch increase in total annual precipitation in western South Dakota since 1976.

Predictions of future temperature changes compared to a 1961–1979 baseline indicate that temperatures in western South Dakota may increase 2–3°F by 2010–2029, as shown in Figure 3-8. Along with generally increasing temperatures, more days are predicted to have maximum temperatures greater than 100°F (USGCRP 2009). 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 is 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.

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

Climate Change Effects on Resources

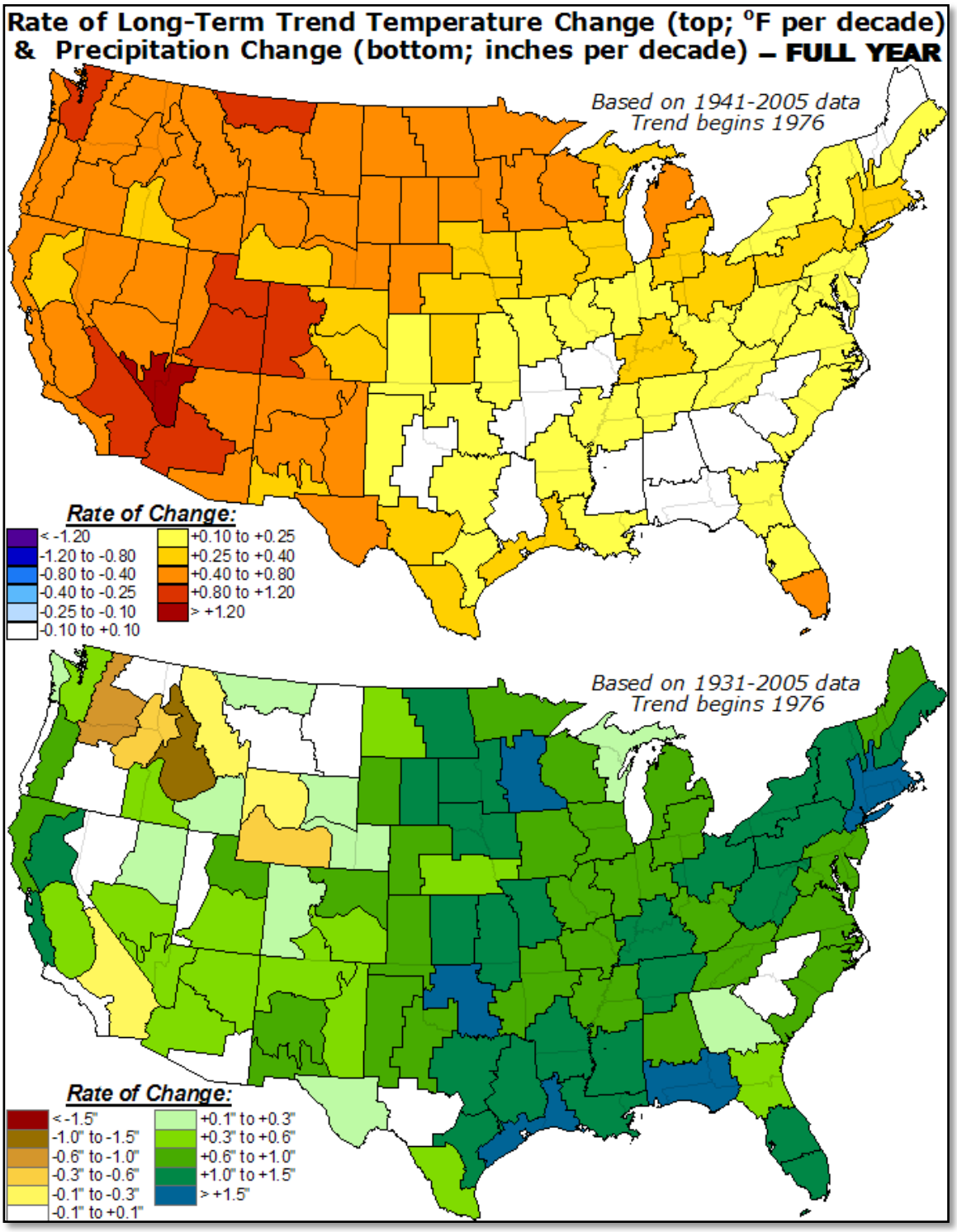
Climate change affects nearly all resources at local, regional, and global levels. The effects of climate change are so widespread that they cannot all be described in this RMP. To illustrate the effects of global temperature change, Figure 3-9 provides broad examples of climate change impacts. As global temperatures increase, effects on 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 would be degraded if dry periods cause increased particulate emissions. Ground-level ozone may also be affected. High temperatures are a contributing factor in ground-level ozone formation, which is also highly dependent on NO_x and VOC concentrations.

Climate change will affect water quality in the planning area. Increasing temperatures 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 more stress to water resources in the region (IPCC 2007). Western South Dakota depends on temperature-sensitive springtime snowpack to meet demand for water from municipal, industrial, agricultural, recreational uses and BLM authorized activities. The USGS notes that mountain ecosystems in the western United States are particularly sensitive to climate change. Higher elevations, where much of the snowpack occurs, have experienced three times the global average temperature increase over the past century (USGS 2012). 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 (USGCRP 2009). Rapid spring snowmelt due to sudden and unseasonal temperature increases can also lead to greater erosive events and unstable soil conditions.

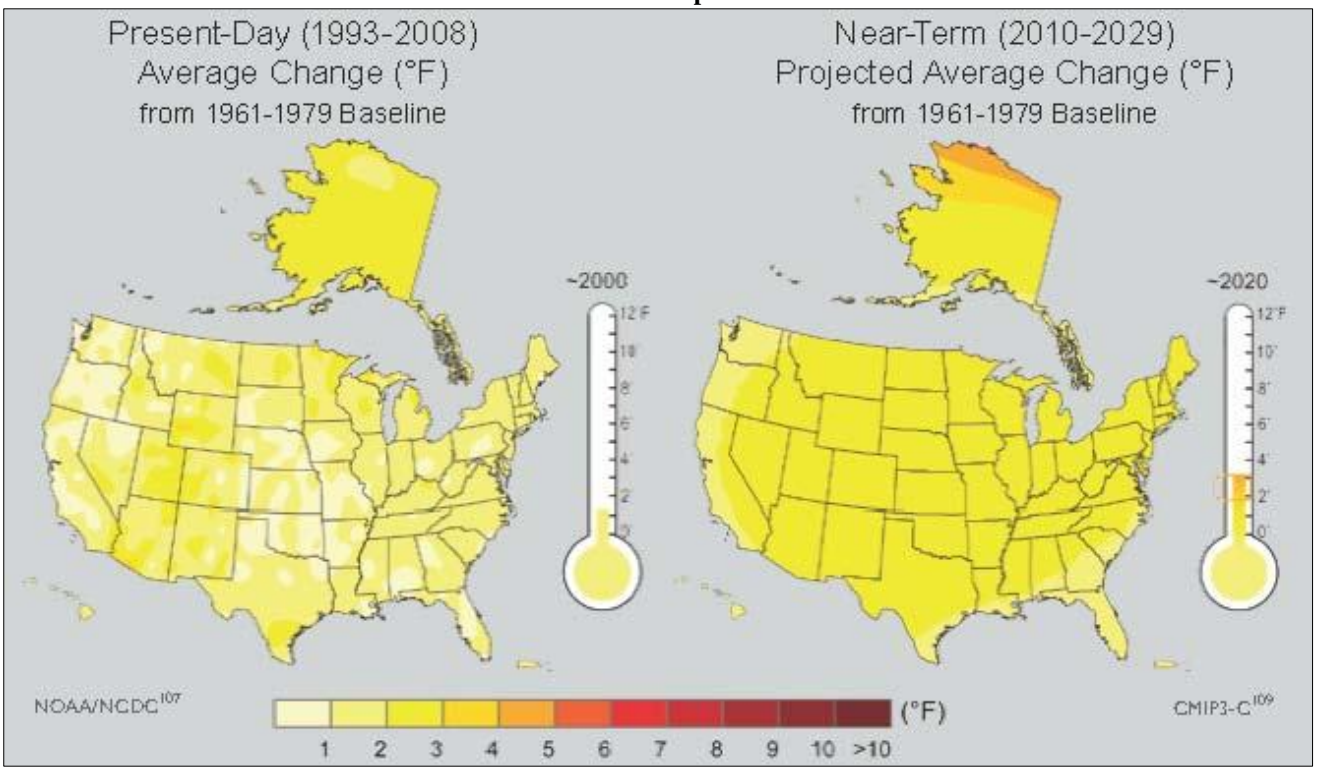
Figure 3-7
Long-Term Historical Temperature and Precipitation Trends



Source: NOAA 2012.

Increases in average summer temperatures and earlier spring snowmelt in western South Dakota are expected to increase the risk of wildfires by increasing summer moisture deficits (USGCRP 2009). Studies have shown that earlier snowmelts can lead to a longer dry season, which increases the incidence of catastrophic fire (Westerling 2006). 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°C (1.8°F) increase in global average temperature, a 393 percent increase in acreage burned in wildfires is predicted in western South Dakota (NRC 2011). Air quality, ecosystem, and economic impacts from wildfires are extensive. Wildfires also release large quantities of CO_2 that would increase atmospheric GHG concentrations.

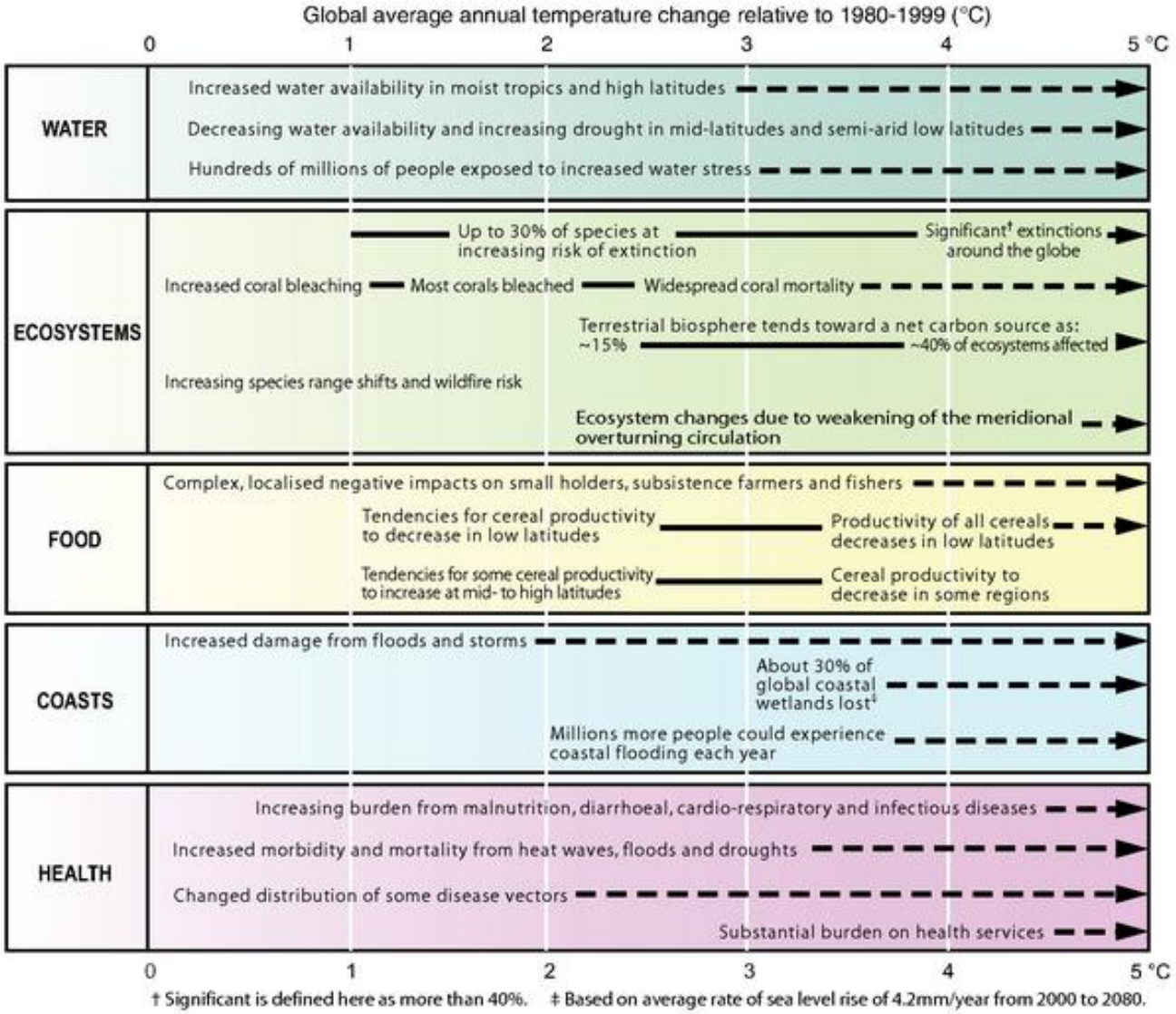
Figure 3-8
Near-Term Predicted Temperature Increases



Source: USGCRP 2009.

There is evidence that recent warming is affecting terrestrial and aquatic biological systems (IPCC 2007). Warming temperatures are leading to earlier timing of spring events such as leaf unfolding, bird migration, and egg-laying (IPCC 2007). The range of many plant and animal species has shifted poleward and to higher elevation, as the climate of these species' traditional habitat changes. As future changes in climate are predicted to be even greater past changes, there will likely be even larger range shifts in the coming decades (Lawler 2009). Warming temperatures are also linked to earlier vegetation growth in the spring and longer thermal growing seasons (IPCC 2007). In aquatic habitats, increases in algal abundance in high-altitude lakes have been linked to warmer temperatures, while range changes and earlier fish migrations in rivers have also been observed (IPCC 2007). Climate change is likely to combine with other human-induced stress 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 that are already stressed by declining habitat, increased development, and other factors, could experience additional pressures due to climate change.

Figure 3-9
Examples of Resource Impacts Due to Climate Change



Source: IPCC 2007. Climate Change 2007: Synthesis Report, Summary for Policy Makers, page 10. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf.

More frequent flooding events, erosion, wildfires, and warmer 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 lead to discoveries of new cultural and paleontological localities.

Climate change also poses challenges for many resource uses on BLM-administered land. Increased temperatures, drought, and evaporation may reduce seasonal water supplies for livestock and could impact forage availability. However, in non-drought years, longer growing seasons resulting from thermal increases may increase forage availability throughout the year. Shifts in wildlife habitat due to climate change may influence hunting and fishing activities, and early snowmelt may 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.

BLM Actions to Reduce GHGs

BLM-administered public lands play an important role in combating further climate change. Vegetation and soil provide carbon sequestration, which is the storage and removal of CO_2 or other forms of carbon from the atmosphere. Management strategies to improve vegetative and soil health provide opportunities for increased carbon sequestration. For example, the need to maintain and improve vegetative condition required by Standards for Rangeland Health (Appendix A) can result in increased carbon sequestration. Prescribed fire can also be a tool to counter the impacts resulting from climate change. Fire is a trigger mechanism for seral stage regeneration and post-burn revegetation can restart carbon sequestration.

Rapid ecoregional assessments are one of the tools the BLM uses to monitor and respond to the effects of climate change. Ecoregional assessments are geospatial landscape evaluations that are designed to identify areas of high ecological value within an ecoregion that may warrant conservation, adaptation, or restoration. These assessments can help to identify resources that are being impacted by climate change and provide information to facilitate the subsequent development of an ecoregional conservation strategy for plants, wildlife and fish communities on public lands. Ecoregional assessments can identify areas, species, and ecological features and services that are sensitive to ecosystem instability and changes in climatic conditions. One of the objectives of the BLM rapid ecoregional assessments is to provide guidance for adaptation and mitigation planning in response to climate change.

Adaptive management is another useful management approach to appropriately anticipate and respond to the uncertainty of impacts resulting from climate change. Adaptive management is useful for complex processes and where potential impacts are large and could affect multiple resources. Adaptive management strategies are iterative processes where monitoring and assessment refine management. This document is based on current scientific knowledge and understanding, which in the case of climate change, is still emerging. Adaptive management provides for new information to be evaluated and incorporated into project level management decisions, best management practices (BMPs), mitigation and the decision-making process. Adapting management to reflect emerging science, projections, and impacts of climate change allows the BLM to adjust management to best meet the challenges of climate change.

Additional Actions to Reduce GHGs

U.S. GHG emissions are expected to decline due to USEPA's listing of GHGs as a regulated air pollutant and implementation of several recent GHG regulatory programs. Facilities with large emissions of GHGs must report these emissions to USEPA and new facilities with large expected GHG emissions must obtain air quality permits and potentially limit GHG emissions. With regard to oil and gas activities, USEPA regulations in 40 Code of Federal Regulations (CFR) Part 60, Subpart OOOO require emission controls or reductions on hydraulically fractured gas wells, oil and condensate storage tanks, gas venting, and equipment leaks that are predicted to reduce national methane emissions by 1 million tons per year. These regulations became effective on October 15, 2012.

The USEPA also requires facilities that emit more than 25,000 metric tons per year (mtpy) of CO_2e to report emissions on an annual basis. Regulations for this reporting program were promulgated under the Greenhouse Gas Mandatory Reporting Rule in 40 CFR Part 98. While most types of sources began reporting emissions for calendar year 2010, onshore oil and gas sources began reporting emissions for calendar year 2011. The USEPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT) website provides public access to the data and became operational in April 2013. The BLM obtained data in February 2014 and assessed emissions and emission sources for calendar year 2012 (USEPA 2014a).

No coal or bentonite mines on BLM surface or mineral estate within the planning area reported GHG emissions under the EPA Mandatory Reporting Rule (USEPA 2014a). Because only underground mines are required to report, it is possible that some surface mines could have had emissions exceeding 25,000 mtpy CO_2e and were not required to report.

Two oil and gas production companies reported activities within the planning area that contributed to emissions exceeding the 25,000 mtpy reporting threshold (EPA 2014a). EPA regulations require that onshore oil and gas facilities

report total GHG emissions for each oil and gas basin in which they operate. Based on EPA's FLIGHT map, the southern portion of the Williston Basin included multiple counties within the planning area. The companies reporting emissions in South Dakota's Harding County also reported emissions from operations in Montana and North Dakota. A method to separate SDFO-specific emissions from Montana and North Dakota emissions was not available.

Within the Williston Basin operations for these two companies, CO_2 accounted for 89 percent of CO_2e emissions, while methane accounted for 11 percent of CO_2e emissions. Most types of reported methane emission sources accounted for less than 1 percent of CO_2e emissions. The largest sources of methane emissions were from associated gas (from oil wells) venting and flaring and equipment leaks other than those from pneumatic pumps and devices (USEPA 2014a).

Within the US 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 also established several initiatives including the development of eight Regional Climate Science Centers. Regional Climate Science Centers would provide scientific information and tools that land and resource managers can apply to monitor and adapt to climate changes at regional and local scales (USDI 2010). The North Central Climate Science Center, which includes the planning area, was established in 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 are formed and directed by land, water, wildlife and cultural resource managers and interested public and private organizations, designed to increase the scope of climate change response beyond federal lands.

In addition to efforts being undertaken to better respond and adapt to climate change, other federal initiatives are being implemented to mitigate climate change. The Carbon Storage Project was implemented to develop carbon sequestration methodologies for geological (i.e., underground) and biological (e.g., forests and rangelands) carbon storage. The project is a collaboration of federal agency and external stakeholders to enhance carbon storage in geologic formations and in plants and soils in an environmentally responsible manner. The Carbon Footprint Project is a project to develop a unified GHG emission reduction program for the USDI, including setting a baseline and reduction goal for the Department's GHG emissions and energy use. More information about USDI's efforts to respond to climate change is available from http://www.doi.gov/whatwedo/climate/index.cfm.

Geology

Due to a variety of rock types, geologic structures and topographic features, many of the economic and recreational opportunities in the planning area are based on its geologic resources. The Black Hills, a prominent geologic feature within the state, is familiar to the public for landmarks such as the Mount Rushmore National Memorial, the Crazy Horse Monument, and historic folklore locales such as the gold mining town of Deadwood. See Figure 3-14 in the Minerals section for a stratigraphic chart of the planning area.

The Black Hills are a regional-scale geologic feature caused by the uplift of basement rocks in the earth's crust (Beck et al. 1988). Erosion has exposed a thick sequence of sedimentary rocks. The oldest rocks occur in the center of the Black Hills and progressively younger rocks outcrop in roughly concentric rings around the periphery of the uplift. The core of the Black Hills is comprised of granite and metamorphic rocks which are the primary source of the gold and other economic hard-rock minerals that occur in the area.

The uplift and initial erosion of the Black Hills was a relatively recent geologic event beginning during the early Paleocene, approximately 66 million years ago (Beck et al. 1988). Prior to that time, most of South Dakota was quite flat and covered periodically by seas. The geologic environment during much of this time resulted in the deposition of marine and low-lying

terrestrial sediments. This provides a fairly complete picture of the geologic history of the northern Great Plains, now visible in the Black Hills area and throughout the western half of the state.

The erosion of the Black Hills has resulted in the deposition of more recent geologic units. The subsequent erosion of these rocks has resulted in the formation of the landscapes associated with the Badlands National Park, located to the south and east of the Black Hills. Overall, the state is characterized primarily by sedimentary rocks that were deposited in seas, rivers and streams, and finally, by the actions of Ice Age glacial processes. Recent erosion has exposed much of these sedimentary strata.

Economic geologic resources in the planning area include oil and gas, bentonite, uranium, and sand and gravel. Oil and gas occurs in the Shannon sandstone, and the Minnelusa and Red River formations. Uranium exploration is focused on the Lakota and Fall River formations in the Belle Fourche/Aladdin and Dewey/Burdock areas.

Historic mining for uranium also occurred in the Cave Hills area, targeting the Fort Union formation, and near Edgemont, mining the Inyan Kara Group (Lakota and Fall River formations). This historic mining occurred in the 1950s to the early 1970s. Commercial bentonite deposits occur primarily in the Mowry shale, although other marine shale units such as the Pierre shale contain localized deposits. Sand and gravel deposits are primarily late Pleistocene or recent deposits, often associated with major streams and rivers. Commercial sand and gravel development is, therefore, limited and localized. (Also see the Minerals and Economics sections for more details on these resources.)

The Black Hills are a favored area for the hobby collection of rocks and minerals. Some minerals, or unusual crystal forms of minerals, are found almost exclusively in the Black Hills and many hobbyists come from all parts of the country to search for mineral specimens. Gold panning is also a popular recreational activity in portions of the Black Hills.

Geologic mapping and monitoring by federal agencies such as the U.S. Geological Survey (USGS) and the Federal Emergency Management Agency (FEMA) identify most of the geologic events, hazards, or phenomena. Most details of geologic events related to safety (sudden events such as mud slides, landslides, and debris flows) are covered in the Public Safety section at the end of Chapter 3.

Soil erosion related to geology is discussed in the Soil Resources section. Erosional features such as buttes occur in several parts of the planning area. Geologic resources may also contribute to the visual resource class of a particular view, and Bear Butte, located near Sturgis, is a classic example. The geology of a planning area is generally stable, as most geologic events occur over vast time periods on the order of thousands to millions of years. However, some notable geologic events such as earthquakes, volcanoes, mud slides, debris flows, and landslides can occur as sudden events.

In the western part of South Dakota, most of the geology is generally stable and has been unchanged for long periods of time; it is not expected to change much over the next 15 to 20 years. The state is relatively quiet seismically (not prone to excessive earthquakes), and no active volcanoes exist.

There is little to no threat of debris flows, volcanic events, or landslides in the planning area. One notable exception is in the Exemption Area of Lawrence County, which is partially managed by the BLM and contains very steep slopes. In addition, the Pierre shale along the Missouri River is known to occasionally slide or slump where bluffs are present (Gries 2005); however, BLM-administered land is limited in these areas.

For fire management, grazing, and/or other actions, the BLM must consider their potential contribution to the likelihood of debris flows and landslides. Erosion is moderately slow in most of the geologic formations in South Dakota. Therefore, relatively few changes or impacts are expected to the geology linked to visual or recreation resources in the planning area in the next 20 years.

Soil Resources

Site-specific soil investigations determine whether soils are suitable or limited for specific proposed actions (including, but not limited to range improvements, mineral development, roads or right-of-way [ROW] locations). Soils are investigated to

determine erosion hazard and reclamation suitability by evaluating slope and soil properties such as texture, organic matter content, structure, permeability, depth, available water capacity, and salt concentration.

BLM data sources for soils include soil survey data, rangeland health assessments, field observations, vegetation monitoring, grazing allotment evaluations, and baseline data provided from previous National Environmental Policy Act (NEPA) analyses. Detailed soil surveys have been published by the Natural Resources Conservation Service (NRCS) for South Dakota. These surveys were completed according to National Cooperative Soil Survey standards and were conducted at the second and third order of detail. Updates for current formats of soil surveys can be found at: http://soils.usda.gov/survey/printed_surveys/.

The NRCS spatial State Soil Geographical Data (STATSGO) is available for all counties in the SDFO RMP area. All counties with public surface acreage have one of these forms of soil survey and include: Brule, Butte, Custer, Fall River, Haakon, Harding, Jackson, Lawrence, Lyman, Meade, Pennington, Perkins, and Stanley counties.

The spatial Soil Survey Geographical Data (SSURGO) is also available for all counties. Both datasets and tabular soil datasets are available on the Internet at the following site: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. This website provides interpretive ratings and soil characteristics for use in general land use planning and management for each soil map unit (several GIS layers with data interpretations have been added to the RMP).

Soils in western South Dakota were derived mainly from weathered sedimentary bedrock, alluvium from mixed sources, and igneous and metamorphic rocks. Differences in climate, parent material, topography, and erosion conditions result in soils with diverse physical and chemical properties. This creates complex and diverse soil patterns, varying greatly in suitability, limitation, and productivity characteristics. Soils in eastern South Dakota were highly influenced by glaciations, and were derived from mixed parent materials that had moved great distances.

The Pierre shale is the most common rock unit on BLM-administered lands within the planning area and can be seen on the surface in most of Butte County, and central and southern Meade County in western South Dakota, and coincides with MLRA-60A (see Figure 3-10). This formation consists of marine sediments containing layers of volcanic ash that has been altered to smectitic clay. This clay shrinks as it dries and swells when it gets wet, causing significant problems for road and structural foundations. In many locations, these soils can also have high salinity or alkalinity contents. Soils in other portions of the planning area include a complex mixture of soils that range from clayey to sandy in texture.

Other soils in the planning area are susceptible to erosion, but most have fewer alkalinity or salinity problems and less shrink-swell potential than those associated with the Pierre shale. Occasionally, nearly barren badlands soils composed of lightly modified, highly erodible softer shales occur in portions of the planning area, especially in Harding and Perkins counties in the northwestern part of the state. Soils in the Black Hills portion of the planning area are shallow to very deep, generally well drained, and loamy or clayey. Rock outcrops are common in the Black Hills area, and gypsum-derived "redbed" soils are common around the outer edge of the Hills.

Managing the soil resource to maintain or improve soil chemical, physical, and biotic properties provides a recovery mechanism for the entire ecosystem. Soil heterogeneity and biodiversity contribute to the soil system's resilience to disturbance and climate change. Adequate vegetative and ground cover (including biological soil crusts and litter) promotes soil health, productivity, and stability, which prevents or limits accelerated soil loss, sedimentation, and degradation. Considering the potential for site recovery from surface uses prior to disturbance, promotes sustainable soil resource use, particularly in areas considered at high risk of degradation from disturbance. The BLM uses best management practices, stipulations such as no surface occupancy (NSO), controlled surface use (CSU), and timing limitations (TL), along with the "Standards for Rangeland Health and Guidelines for Livestock Grazing Management for the Dakotas (BLM 1997a) to maintain or increase ground cover and reduce soil damage and loss from headcuts and mass wasting, reduce sedimentation to streams and rivers, and maintain or improve soil condition and fertility.

Major Land Resource Areas

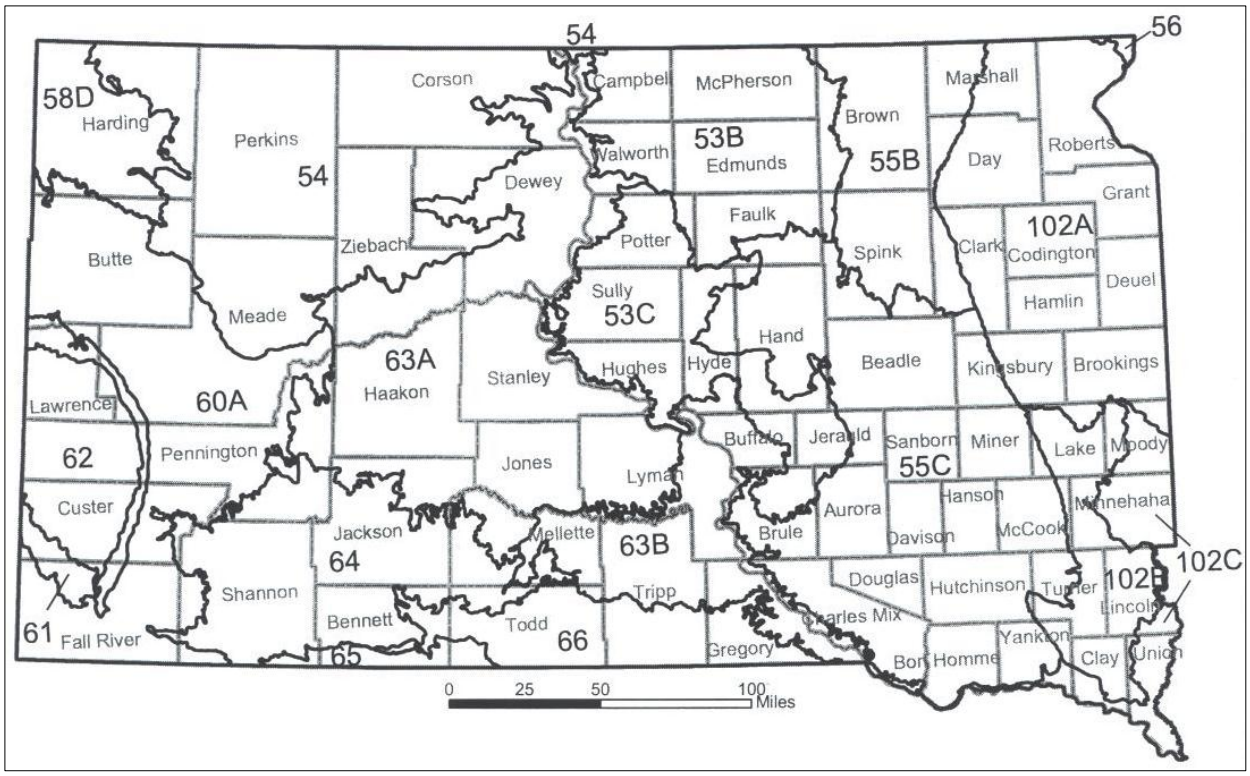
Major Land Resource Areas (MLRAs) are based upon aggregations of geographically associated land resource units and identify nearly homogeneous areas of land use, elevation, topography, climate, water resources, potential natural vegetation, and soils. The descriptions of the map units on major land resource area maps emphasize land use and water resource management. Major land resource areas are most useful for statewide planning and have value for interstate, regional, and national planning. (USDA Agriculture Handbook 296. USDA. NRCS)

For descriptive purposes, the planning area soils are grouped geographically by Major Land Resource Areas (MLRA) (see Figure 3-10). The detailed descriptions of MLRAs, including a description of soils and geology, are derived from the USDA Agriculture Handbook 296 (USDA, NRCS 2006). (Refer to the Vegetation section for information on vegetation and land use in the MLRAs discussed.)

Currently, soil resource conservation and improvement is an essential component of land management within the planning area. Ongoing activities in the planning area that affect the condition of the soils include: mineral exploration and development, livestock grazing, vehicle use (on and off road), recreation, infrastructure development, and fire suppression. Soils have generally been in good to fair condition, with erosion problems generally occurring in isolated areas such as around roads and trails, stock tanks, salt licks, and some mining operations. When drought occurs, the risk of loss of soil cover and subsequent soil erosion are greatly elevated.

Key management concerns for the planning area regarding soil resources are surface use effects on steep slopes, sensitive soils, and badlands and rock outcrops. Sensitive soil characteristics are defined to include: erodibility (by water and wind), slope, compaction, hydric status, fugitive dust resistance, and restoration potential. Criteria used to determine soil sensitivity to surface uses is continually being adapted as conditions change or new information or technology becomes available. Please see the definition for these terms within the Glossary for how these are defined within this planning document.

Figure 3-10
Planning Area Showing Counties and Their Associated MLRA Designations



Acres of soil characteristics are shown in Table 3-8. These soils have a high potential for negative impacts when disturbed.

Table 3-8
Soil Characteristics within the Planning Area

	Acres of BLM-Administered Surface	***Acres of Federal Minerals****
Low fugitive dust resistance	11,353 (4.1%)	106,035 (7.8%)
Low restoration potential	34,601 (12.6%)	211,808 (15.5%)
Sensitive Soils	144,171	875,177
Badlands and Rock Outcrops	24,222	154,786

* Does not include federal minerals that are not addressed in the Proposed RMP/Final EIS.

Factors Affecting Soils

Surface-disturbing activities within the planning area remove protective vegetative cover and can alter soil physical, chemical, and biological properties, resulting in increased soil susceptibility to water and wind erosion and decreased soil potential and site productivity. Water erosion could result during high intensity runoff events. Soils are most susceptible to wind erosion when soil aggregates are broken up and dry conditions exist.

Soil compaction results from equipment, vehicles, humans, and animals traveling over trails, roads, and land. Severity of compacted soils depends on soil type, soil moisture, vegetative cover, and the frequency and weight (lb/sq. inch) of the source of the impact. Compaction alters soil structure by reducing infiltration and permeability rates, which in turn increases runoff, erosion, and potential sedimentation. Soil productivity and vegetative vigor can decrease. Soils are the most susceptible to compaction during moist conditions.

The planning area contains naturally erosive soils. Additional anthropogenic, or human caused, disturbance (such as vegetation, soil crust, and/or litter removal) resulting in soil loss beyond natural rates, or "accelerated erosion," causes a decline in site potential and productivity, as well as sedimentation and a reduction of stream health. Sedimentation alters stream conditions by increasing salt content, reducing sunlight, changing temperature, abrading or suppressing organisms, and/or smothering eggs. Nutrients in eroded topsoil such as nitrogen and phosphorous can cause eutrophication (enriched nutrient levels) which can cause algal and vegetative blooms which reduce oxygen levels in water bodies. Steep slopes are an indicator of greater potential for water erosion. Low fugitive dust resistance is an indicator of greater potential for wind erosion.

Steep slopes can be found across the planning area but are most common in the Exemption Area, Fort Meade, southern Black Hills, and the Two Rivers and other river breaks. Steep slopes (those at 25 percent or greater) are particularly at risk of water erosion following a disturbance. Depending on soil type and rock fragment content, roads and trails on slopes greater than eight percent and off-highway vehicle (OHV) use on slopes greater than 26 percent are at a severe risk for water erosion (NRCS 1998). As slopes approach 30 percent, the risk of soil instability increases (Monsen et al. 2004; NPI 1985). Management actions by the surface owner that alter soil characteristics, such as plant cover, soil structure, permeability, and bulk density and compaction, may increase erosion by water, which could result in sedimentation (Monsen et al. 2004).

The following sections discuss in more detail those soil characteristics affecting soil resources: fugitive dust resistance, steep slopes and restoration potential.

Fugitive Dust Resistance

Following the removal of protective vegetation, wind erosion is a critical issue which results in the displacement or loss of topsoil in some areas, increased sediment deposition in other areas, and impacts to ambient air quality from elevated dust levels (see the Air Quality section).

Fugitive dust resistance rates the resistance of a site to eroded soil particles going into suspension during a windstorm. Fugitive dust can create extreme visibility reductions during severe wind storms, creating traffic hazards and closing airports. Power outages, expensive cleanup costs, damage to computers and communications equipment, as well as respiratory problems can be caused by fugitive dust.

Soil particles and nutrients can be moved and deposited thousands of miles away as a result of wind erosion. This fugitive dust, which causes a decline in air quality by increasing opacity and corrosiveness, is a source of PM_{10} and $PM_{2.5}$ air pollution regulated by the EPA (USEPA 2010a; Soil Survey Staff 2010). PM_{10} and $PM_{2.5}$ are defined as particulate matter with a mean diameter less than 10 microns and 2.5 microns, respectively. These soil particles are very small, can remain suspended in the air for long periods of time, and are easily inhaled deeply into the lungs. Increased risk of death and disease has been linked to periods of high outdoor PM_{10} and $PM_{2.5}$ concentrations. These fine particles can potentially be lifted thousands of feet into the atmosphere and transported across continents and oceans creating global health, ecological, and climate change impacts.

The loss of top soil can impact vegetation by reducing the A and B soil horizons limiting productivity and soil moisture. Additionally, the dust may inhibit vegetative productivity by reducing sunlight or smothering vegetation. Soil characteristics used to determine soil resistance to forming fugitive dust include: particle size; rock fragment, organic matter, and moisture content; calcium carbonate equivalent; aggregate stability; crust stability; and freeze periods. Soil particles smaller than 100 microns can be suspended in the air and contribute to fugitive dust. Clay particles tend to form large, durable soil clumps and do not create fugitive dust unless these clumps are broken down by repeated surface disturbance.

Rating class terms describe to what degree soil characteristics affect the formation of dust. "Low resistance" indicates that the soil has features that are very favorable for the formation of dust. "Moderate resistance" indicates that the soil has features that are favorable for dust formation. "High resistance" indicates that the soil has features that are unfavorable for dust formation.

Steep Slopes

The probability of successful revegetation decreases as slope increases, particularly for slopes greater than 20 to 30 percent (Monsen et al. 2004). No matter the quality of rehabilitation, sites with poor restoration potential may never recover from disturbance or degradation. Conversely, soils resilient to surface use have the potential to continue to function well following disturbance. Such soils would be prime candidates for land use activities; planning projects on these sites would minimize the costs of mitigation and reclamation. On-site investigation is recommended before undertaking any restoration project.

Restoration Potential

Potential for restoration is based upon the natural ability of the soil to recover from degradation, often referred to as soil resilience. Whether or not the soil resource is suitable to be restored or reclaimed depends on the reclamation action, time of year, and various soil characteristics. Soils poorly suited to successful reclamation have characteristics such as high soluble salt content, a high proportion of sodium salts, poor water holding capacity, inadequate rooting depth, poor soil structure, low precipitation, organic matter, and nutrients; and/or are highly erosive.

Soils dependent on biological soil crusts for erosion control, moisture retention, and nutrient cycling can be severely degraded if the crusts are damaged.

Rating class terms indicate how suitable soils are to recover after disturbance. "High potential" means that the soil has features very favorable for recovery. Good performance can be expected. "Moderate potential" indicates that the soil has features that are generally favorable for recovery. Fair performance can be expected. "Low potential" indicates that the soil has one or more features that are unfavorable for recovery. Poor performance can be expected.

Soil Potential and Productivity

Soil potential and productivity drive ecological systems. Soils provide the living framework from which ecosystem services and renewable resources are generated, the quality of which is dependent on soil system health. Soils are also an engineering medium upon which roads, trails, and facilities are built.

Indicators of soil resource condition include both visual and non-visual factors. Some indicators are indirect. Visual indicators include evidence of soil loss (water and wind erosion) or transport (mass movement, slope failure, and deposition), changes in soil profile (thickness and structure), changes in vegetation (species, abundance, and seral stage), changes in drainage, and changes in land use (grazing, cultivation, and development). Changes outside the normal range are identified by comparison to historical observations or to similar areas (also called "control" or "reference" areas).

Non-visual indicators of soil condition include soil chemistry (pH, salinity, and sodium absorption ratio [SAR]), physical properties (permeability and infiltration rates moisture retention), and yield or productivity (BLM Standards for Rangeland Health 1997).

Water Resources

Groundwater

Importance of Groundwater

South Dakotans are dependent on groundwater, as safe and adequate water supplies are vital for health and necessary for local and regional economic development within the state. Approximately four-fifths of South Dakotans rely on groundwater as the source of their private and public domestic water supply. Groundwater also provides the base flow to streams in many areas of the state and is essential to watershed ecology.

About two-fifths of the 400 to 500 million gallons of water used every day in South Dakota is groundwater and is used for domestic, commercial, livestock watering, irrigation, mining, and industrial purposes. The two most significant groundwater uses are for irrigation and domestic purposes, with irrigation being the largest use. Groundwater supplies about one-third of the quarter billion gallons of water used for irrigation per day. Over four-fifths of the state's public water supplies rely on groundwater. Virtually all residences and businesses not served by a public water supply system are dependent on groundwater for domestic use (http://pubs.usgs.gov/ha/ha730/ch_i/index.html).

Availability and Use of Groundwater

While the State of South Dakota is fortunate to have relatively large quantities of high-quality groundwater (Table 3-9), several issues currently limit the physical availability of water in the planning area. The two main issues are that the depth of groundwater and the lack of power to the isolated planning area preclude many well sites from being developed. In some areas, cost-share projects with private parties, government agencies, and wildlife foundations are a means of providing funds to help offset the cost of development of drilled wells and the associated water systems (pumps, pipelines, and storage tanks).

For domestic purposes, the largest amounts of groundwater are withdrawn from the Madison and Minnelusa aquifers in the Black Hills in western South Dakota. However, use of the Madison and Minnelusa aquifers outside of the Black Hills region is generally limited due to economic considerations related to depth and water quality considerations. For irrigation purposes the largest amounts of groundwater are withdrawn from the Ogallala aquifer, located in the south-central portion of the state. The storage capacity of the Ogallala aquifer is relatively small, compared to the Madison and Minnelusa aquifers. Bedrock

Management of Water Resources

The BLM's SDFO manages water resources both for its resource values (watershed health wildlife, riparian, etc.) and resource uses (recreation, water supply, etc.) within the framework of applicable laws, regulations, and agency policies. In South Dakota, all water (surface and groundwater) is the property of the people of the state, according to state law (http://denr.sd.gov/des/wr/wr.aspx). The BLM files claims to apply for water rights to all existing water developments and natural water sources on BLM land under the same regulations as all other applicants.

aquifers are the primary source of drinking water in the Black Hills area of western South Dakota.

While the alluvium makes up a small portion of the total groundwater resource, it provides a disproportionate amount of usable water. This groundwater occurs in shallow, unconsolidated materials such as alluvium or terrace deposits, as well as in deeper consolidated rocks such as sandstone, shale, coal, and limestone. It is primarily located in the Late Tertiary aquifers. This important source of water consists mostly of sand and gravel deposits commonly interbedded with silt and clay. These aquifers consist mostly of alluvium deposited by meandering streams across a wide, gentle plain. Locally, coal beds that are exposed at the land surface have been ignited naturally and the burned coal has formed highly permeable clinker beds that contain high-yielding local aquifers.

The permeability of the Late Tertiary aquifers is variable and directly related to grain size and sorting of the deposits that compose the aquifers. Where the aquifers consist primarily of sand and gravel, they are extremely permeable; permeability decreases as clay content increases. Generally, the Late Tertiary aquifers become more clayey and less permeable as depth increases. Most wells completed in these South Dakota aquifers yield 100 gallons per minute or less and rarely exceed 1,500 gallons per minute because of their poor permeability. Because the Late Tertiary aquifers usually are at shallow depths, most wells completed in the aquifers are less than 600 feet deep.

Table 3-9
Aquifers Showing Total Recoverable Groundwater in Western South Dakota

Aquifer	***Area of Aquifer (acres)***	***Recoverable Water (acre-feet)***
Alluvium	2,823,040	2,828,040
Arikaree Group	2,541,440	7,624,320
Dakota-Newcastle Formation	22,158,720	308,442,000
Deadwood Formation	19,159,040	280,475,200
Fort Union Group	1,443,840	23,037,600
Fox Hills Formation	7,441,920	55,814,400
Hell Creek Formation	5,390,720	82,190,400
Inyan Kara Group	23,239,040	324,169,440
Madison Group	19,116,160	644,827,200
Minnekahta Limestone	15,960,320	39,900,800
Minnelusa Group	23,114,880	755,555,520
Ogallala Group	1,140,360	19,929,600
Precambrian	533,120	2,665,600
Red River Formation	14,881,280	545,386,240
Sundance Formation	19,102,080	165,838,080

Unconsolidated-deposit aquifers in sediments of Quaternary age are the source of water for many shallow wells. These aquifers consist primarily of sand and gravel. Commonly, the aquifers contain clay and silt either mixed with the sand and gravel or as beds or lenses; where bedded, the clay and silt form confining units. Unconsolidated-deposit aquifers generally are thin, narrow bands and are in narrow valleys along major streams in western South Dakota. These aquifers in stream-valley alluvium locally yield sufficient water for some uses but generally are less productive than the other unconsolidated-deposit aquifers.

Depending on the setting, groundwater can be intricately linked with surface water. In many cases, groundwater is the primary source of water in streams and rivers during the fall and winter ‘base flow’ period and may be the primary source of lake water. Groundwater is vital to wetlands and riparian areas. Lowering of the water table that occurs due to irrigation along rivers and streams and from developed wells reduces available stream flows for fisheries and degrades riparian corridors and wetlands. Development of groundwater wells and springs for human and livestock use, especially irrigation, lower the water table, which could reduce the base levels in streams and lakes.

Total withdrawals of fresh groundwater in South Dakota during 1990 were 251 million gallons per day. Water withdrawn for different uses was first for agricultural use, primarily irrigation, and secondly for the public supply.

Water Quality and Threats

The concentration of dissolved solids in groundwater provides a basis for categorizing the general chemical quality of the water. Dissolved solids in groundwater primarily result from chemical interaction between the water and the rocks or the unconsolidated deposits through which the water moves. Rocks or deposits that consist of readily dissolved minerals will usually contain water that has large dissolved solids concentrations. The rate of movement of water through an aquifer also affects dissolved solids concentrations; the longer the water is in contact with the minerals that compose an aquifer, the more mineralized the water becomes. Dissolved solids concentrations in groundwater generally are small in aquifer recharge areas and increase as the water moves downward into the deeper parts of the aquifers. Thus, larger concentrations of dissolved solids commonly are in water at or near the ends of long groundwater flow paths. Aquifers that are buried to great depths commonly contain saline water or brine in their deeper parts, and mixing of fresh groundwater with this saline water can result in a large increase in the dissolved solids concentration of the fresh water.

Groundwater resources of the planning area are affected directly or indirectly by activities such as domestic consumption, irrigation, livestock use, industry, mining, logging, recreation, transportation, wildlife, and aquatics. These interdependencies can affect human health, wildlife, engineered structures, and economics of the region. The primary beneficial uses of water on public land include agriculture, support of wildlife, and recreation. Water use on private land within the area is primarily for agriculture and domestic activities. Contamination that is the result of human activities can increase the concentration of dissolved solids in groundwater; such contamination usually is local but can render the water unfit for human consumption or for many other uses. Large secondary porosity and permeability from fracturing or solution enhancement allows extremely rapid infiltration of recharge with very little filtering of potential contaminants. Extensive development occurring in recharge areas has potential for introduction of contaminants. Contamination of bedrock aquifers could impair the quality of water supplies.

Laboratory analysis of water samples collected from the statewide groundwater quality monitoring network indicates that the overall quality of the shallow groundwater is good. However, water quality degradation or contamination results from pollution in some localized areas. Aquifers that are shallow, unconfined, and receive recharge at rapid rates are most susceptible to contamination from human activities because water quickly infiltrates from the land surface to such aquifers; thus, contaminants have little potential to be absorbed by soil minerals or dispersed, and might be undiluted or only slightly diluted when they enter the aquifer. Aquifers that consist of limestone, dolomite, or basalt are particularly susceptible to contamination because they commonly contain large openings (solution cavities, joints, or cooling fractures) that allow water to enter the aquifer almost instantaneously. Confined aquifers are less susceptible to contamination than unconfined aquifers because the confined aquifers usually are deeply buried and are overlain by confining units that have minimal permeability. Infiltration of contaminants into confined aquifers, therefore, is slow and the contaminant is more likely to be absorbed by the confining unit.

Groundwater contamination that results from human activities can take place more rapidly than natural contamination. Such contamination is categorized as being from either a point source or a nonpoint source. For example, if uncased wells are drilled deep enough to penetrate an aquifer that contains saline water under artesian pressure, then the saline water can rise through the borehole and spread outward to contaminate shallower aquifers that contain fresh water. This type of point source is only possible where the hydraulic head in the shallower aquifers is less than that in the aquifer that contains saline water. State and federal regulators normally require appropriate precautions if such hazards are known. Nonpoint sources are possible in agricultural areas where groundwater quality can be degraded by the application of agricultural chemicals. This type of agricultural pollution has been found in South Dakota by the USGS in its statewide groundwater quality

Point Source

A point source is a specific local site such as an underground storage tank that contains wastes, petroleum, or chemicals; a landfill; a storage pond, pit, or lagoon; a spill of hazardous chemicals or petroleum products; or a disposal or injection well that receives municipal or industrial wastes. Nonpoint contamination sources are large scale and can extend over hundreds of acres. Examples of nonpoint sources are agricultural activities, such as the application of fertilizer or pesticides to fields; urban areas with concentrations of septic tanks and cesspools; encroachment of saltwater or highly mineralized geothermal water; animal feedlots; mining operations; oilfields and associated tank farms; salt from highway de-icing; and concentration of salts from mineralized irrigation water in places where evaporation rates are high and the soil is poorly drained. (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm/)

monitoring network. However, in certain areas, elevated nitrate concentrations in the groundwater have been determined to be naturally occurring.

Wildfire and prescribed fires also have the potential to impact groundwater. Groundwater availability and quality are not usually significantly affected by prescribed fire or mechanical treatments, although the effects can be positive. Groundwater can be significantly affected by large wildfire, although the effects of fire are normally small since most fires are small and vegetative communities eventually recover.

Increased use of planned ignitions could reduce the amount of groundwater lost to excessive runoff due to excessively hot, intense landscape-destroying wildfire. The type and intensity of fires can affect whether there will be a lot of runoff all at once or whether there will be a lot of infiltration, groundwater recharge, and steady discharge to streams all year long. The BLM's Fire and Fuels Program improves these potential situations (see the Fire Management and Ecology section).

The larger the acreages of prescribed fire and mechanical treatments, the more positive are the effects overall. The larger the acreages of large wildfires, the more negative the effects. In either case the effects can be significant if on a large enough scale. They also can gradually change through time due to natural plant succession, which affects water infiltration and runoff.

Hard Rock Mining

In areas where hard rock metallic (gold, silver, copper, lead, zinc, etc.) ores have been mined and not reclaimed, potential for groundwater contamination exists, especially when sulfide-containing rocks (which have acid-generating potential) are involved. The mining process usually involves crushing rock. When these discarded, finely subdivided sulfide rocks are exposed to water and air (oxygen) they can change, assisted by bacterial action, from insoluble sulfides to soluble sulfates. Sulfates are acidic and make most metals more soluble. Precipitation then entrains the sulfates and metal ions (called acid mine drainage) which can pollute surface water and groundwater. The generation of acidic water can be retarded when it interacts with alkaline-rich rock types, such as limestone and dolomite. Current mining regulations largely prevents such problems, but many old mines (and in some cases, recent mines) remain which continue to pollute water.

Old, unreclaimed coal or bentonite mining can result in the release of sediments, sodium, and other salts. Among others, phosphate mining and uranium mining can result in radionuclides leaching from mine tailings, and even oil and gas production can result in some accumulations of naturally occurring radioactive materials.

Mining was unregulated in the past, and lingering effects from that continue on public and private lands. However, federal and state programs have been in effect since mining regulations were implemented starting in the 1960s by the federal government, and by the State of South Dakota starting in 1971, to clean up problems of which the public was becoming more aware. The regulations prevent the worst of these effects in current operations.

Oil and Gas Drilling

In oil and/or gas well drilling, viscous drilling fluids must be used in well bores to cool and lubricate the drill cutting bit and bring rock cuttings to the surface, so the well bore can be drilled and deepened. Wells that drill through salt formations must use saturated salt water and/or some kind of oil to limit dissolution of the geological salt formations being drilled through, thus avoiding unnecessary complications such as the wellbore collapsing and seizing up of a drill bit or pipe. Most wells drilled in the Williston Basin or its outliers as well as other basins containing salt formations use a drilling fluid of saturated saltwater brine or a combination of saltwater and oil based fluid, usually diesel oil (less often mineral oil, or rarely synthetic oil). Diesel oil contains more aromatic hydrocarbons with toxic qualities, such as benzene, toluene, ethylbenzene, and xylene (BTEX). Mineral oil contains a higher proportion of much less toxic aliphatic hydrocarbons like alkanes. Synthetic oil is primarily composed of esters, ethers, and olefins. Drilling fluids are usually contained on the well location in an excavated "reserve pit." A common size for reserve pits is 180 feet by 60 feet by 12 feet deep for deeper wells, which would yield about a half million gallons or more of actual capacity used to hold drilling mud and cuttings. Pits in the Williston Basin have contained up to 440,000 pounds of sodium chloride (salt), although more commonly pit contents have been less than 200,000 pounds of sodium chloride. Saturated salt water is about 26.5 percent salt, although the percentage can vary slightly depending on temperature (http://veegee.thomasnet.com/viewitems/sodium-chloride-hydrometers/sodium-chloride-nacl-hydrometers-by-weight?forward=1).

The use of saltwater and oil-based mud systems can contaminate groundwater by infiltration or injection via a wellbore and surface water through the groundwater connectivity. The contamination of groundwater resources by drilling or formation fluids can be prevented through the use of fresh water mud and cemented in casing. The surface hole (the first part of the wellbore) is drilled with fresh water and no salt or materials having toxic effects are used during that part of the operation. After drilling the surface hole, casing (steel pipe) is placed in the hole and cement is circulated to the surface and allowed to harden, which cements the casing to the geologic formation. This casing and cement protects the fresh and usable water zones while completing the drilling operations with salt water or oil based mud. The casing also provides protection during production operations and well control operations. Table 3-10 lists broad categories of drilling mud constituents, as well as typical constituents.

Table 3-10
Categories of Drilling Mud Constituents

Broad Categories of Drilling Mud Constituents	Amine-treated organic materials Corrosion inhibitors Defoamers Emulsifiers Emulsifiers Flocculants Foaming agents Shale control inhibitors Surfactants Temperature stability agents Thinners/dispersants Viscosifiers Weighting materials Wetting agents
Types of Mud Constituents	**Typical constituents**
Mild, Innocuous	Bentonite clay Cedar fiber Cornstarch Cottonseed hulls Durum based colloid Leonardite (decomposed lignite coal) Muscovite mica Other clays such as montmorillinite, sepiolite, and attapulgite Sawdust Shredded paper Sodium carbonate (baking soda) Sugar cane bagasse (fibrous remainder of sugar cane after sugars are removed) Walnut shells And others
Uncertain Category	Aluminum stearate Ammonium thiocyanate Barium sulfonate Detergents Sulfurized amine borate salt
More Toxic	Ammonium bisulfate Chrome lignosulfonate Methanol Organic chemicals Paraformaldehyde, formaldehyde, and many other bacteriacides Phosphoric acid

	Sodium bichromate (sodium dichromate), ammonium nitrate, sodium pentachlorophenate, among many others containing heavy metals Various strong hydroxides such as calcium hydroxide and sodium hydroxide Zinc carbonate Etc.

Sources: BLM 1992 and 2009.

A reserve pit constructed to contain the drilling fluids is normally excavated and lined to prevent or reduce leakage of the pit contents into the surrounding soils or groundwater. The reserve pit is designed to contain and circulate the drilling fluids and collect rock cuttings from the bottom of the drill hole, and to withstand the low fluid pressure of the pit contents for a short time. Some liners typically used for reserve pits are readily broken down into separate plastic strands in open-air, sunlit conditions in a period of months. Liners usually remain largely intact under drilling conditions if used soon after installation. At times, visible tears can develop at stress points caused by shifting soil material, the weight of cuttings and fluids on tightly installed liners and over rough rocks, from accidents, and from poor handling of equipment. An uncertain number of liner failures can exist out of sight below the cuttings and drilling fluids for the same reasons mentioned.

An unknown quantity of drilling fluid material (quite varied from well to well) is lost in various formations down hole. Bentonite clay coating the sides of a hole usually holds down the rate of loss, but sometimes other materials are needed (e.g., shredded paper, mica flakes, or cedar fiber) to decrease the permeability of some formations due to the excessive loss of drilling fluid into the formation.

After drilling an oil or gas well is completed and any bentonite clays settle out from drilling fluids, much of the liquid fraction of the separated fluids can be removed from the reserve pit. The separated fluids are required to be disposed of in a state-approved disposal well or used for drilling another well. A portion of any hazardous materials or substances with toxic effects added to, or held within, the mud system during drilling operations, and not attenuated in some way by operations (such as loss down the drilled hole), or disposal down a disposal well, and/or chemical changes such as neutralization, are contained in the closed reserve pit. Reserve pits when closed can still be up to half full (BLM 1992), containing saturated rock cuttings from the wellbore and settled-out bentonite, saturated with a large portion of all the constituents of the drilling fluids. The intent of pit filling and closure is to keep the liner in place and intact, however, the longevity of liners under the conditions of dirt work closure and long-term contact with drilling chemicals is largely unknown.

Pits are nearly always covered with the same site material which was excavated to create the pit, and is normally permeable to various degrees. Infiltrating rainwater (or even groundwater in some cases) can pass through this cover and enter the buried pit. Fluids can mix with, dissolve, or form an emulsion with materials in a pit and exit the buried lined pit via holes made by intentional breaching, caused by drilling operations, caused by environmental and chemical degradation, or fluids could fill and flow over the top of an intact buried pit. Two studies by the North Dakota Geological Survey in the 1980s (Murphy and Kehew 1984; Beal et al. 1987) show the movement of pit contents underground. In the studies, pits were investigated which were intentionally breached, a practice now highly discouraged. However, the results still illustrate the kind of movement that could result from a pit whose liner is also unintentionally compromised or filled and overtopped with accumulating precipitation. As expected, flow through fine geologic materials is notably slower than through coarse geologic materials. Unknown quantities of the remaining mud constituent chemicals could quite plausibly leave the confines of buried pits. The result can then be an unknown amount of contamination of the surface soils, surface water, and groundwater resources. Evidence of this can at times be seen over closed reserve pits, when salts have diffused up to the surface following accumulating water in soil pores. This is revealed by poor plant growth and soil characteristics typical of influence from large concentrations of sodium salts from a covered pit. There is no direct documentation of problems in groundwater caused by drilling fluids in South Dakota. There are no studies which have investigated the subsurface or groundwater for potential effects in areas developed for petroleum in South Dakota.

Shallow groundwater, occurring in river and stream valleys, could be initially affected by potential leaks during drilling, and to a lesser extent, after removal of the drilling mud fluids which have separated from any bentonite and other solid materials. Deeper groundwater, occurring in underlying strata, could potentially be affected later, since it would require

more time for the contamination to enter the aquifer. This is dependent upon the porosity and permeability of the aquifer and the material overlying the aquifer. If clay or shale strata were present around and below a closed reserve pit, the fine particles would tend to absorb some of the salts and fluids which exit a closed reserve pit. The basic soils and strata in most of the area would tend not to neutralize any of the hydroxides; however, acid shales present in some areas could tend to have a neutralizing influence on some hydroxides.

Hydraulic Fracturing

Hydraulic fracturing (fracking) has been utilized by the oil and gas industry since the late 1940s. Within the planning area, hydraulic fracturing, in conjunction with horizontal drilling described above, may allow for development of unconventional zones that were once considered uneconomical, like the Bakken and Three Forks Formations in the Williston Basin area. The Bakken does not extend to South Dakota. The Three Forks extends into the northwest corner of South Dakota, but is not currently a drilling target in that area. The Red River Formation does not need fracking to be productive. Other formations may become targets in the future. Extensive horizontal fracking is not occurring in South Dakota.

Hydraulic fracturing is a technique used to create additional space and connecting existing fractures and existing rock pores with newly created fractures that are located in deep underground geologic formations. The induced space allows the rock to more readily release oil and natural gas so it can flow to the surface via the well bore that would otherwise be uneconomical to develop. Wells that undergo hydraulic fracturing may be drilled vertically, horizontally, or directionally and the resultant fractures induced by the hydraulic fracturing can be vertical, horizontal, or both. The typical steps of hydraulic fracturing can be described as follows:

1. Water, sand and additives are pumped at high pressures down the wellbore.
2. The liquid goes through perforated sections of the wellbore and into the surrounding formation, fracturing the rock and injecting sand or other proppants into the cracks to hold them open.
3. Experts continuously monitor and gauge pressures along with the volume of fluids and proppants, while studying how the sand reacts when it hits the bottom of the wellbore; slowly increasing the density of sand to water as the frac progresses.
4. This process may be repeated multiple times, in "stages" to reach maximum areas of the wellbore. When this is done, the wellbore is temporarily plugged between each stage to maintain the highest water pressure possible and get maximum fracturing results in the rock.
5. Frac plugs are drilled or removed from the wellbore and the well is tested for results.
6. The water pressure is reduced and fluids are returned up the wellbore for disposal or treatment and re-use, leaving the sand in place to prop open the cracks and allow the oil/gas to flow to the well bore.

Fracturing fluid is typically more than 98 percent water and sand, with small amounts of readily available chemical additives used to carry the proppant and control the chemical and mechanical properties of the water and sand mixture. Proppant, consisting of synthetic or natural silica sand, may be used in quantities of few hundred tons for a vertical well to a few thousand tons for a horizontal well. The amount of water needed to fracture a well in the planning area depends on the geologic basin, the formation, and depth and type of well (vertical, horizontal, directional), and the proposed completion process.

Several sources of water are available for hydraulic fracturing in the planning area. The Appendix E.9 *Oil and Gas Supplementary Information* contains further details on sources of water that could potentially be used for hydraulic fracturing or drilling operations. The use of any specific water source on a federally administered well, requires the proposal be reviewed and analyzed through the NEPA process for BLM approval during the APD stage to ensure compliance with South Dakota water laws and federal regulations.

Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface in accordance to Onshore Order #2, South Dakota Department of Environment and Natural Resources – Oil and Gas Division (SDDENR-OG Div) rules and regulations, and API standards. The cemented well is pressure tested to ensure there are no leaks and a cement bond log is run to ensure the cement has bonded to the casing and the formation.

SD DENR regulations also take measures to protect all resources including groundwater. In accordance with State of South Dakota Oil and Gas Conservation Rules17:12:02:17 and 17:12:02:19, operators are required to disclose and report the amount and type of fluids used in well stimulation to the Interstate Oil and Gas Compact Commission/Groundwater Protection Council hydraulic fracturing web site (http://FracFocus.org).

The Future

As more people build adjacent to public lands, especially in the Exemption Area and the Fort Meade Recreation Area, demand for quality water sources, especially groundwater, will increase. Actions on public lands have the potential to affect groundwater availability and quality on both public and private lands. Groundwater may travel through aquifers and subsurface layers affecting water quality and quantity for long distances. The same is true for the impacts to the BLM-administered lands resulting from actions on private lands. As more people move near the BLM public lands, the associated increase in septic systems and management actions (insecticides/herbicides, grazing practices, and agricultural use) have the potential to impact subsurface water quality and quantity on public lands.

Historical meteorological data, as well as evidence from the geologic record, suggest that climate conditions have been highly variable in the region, punctuated by prolonged cycles of drought. Current data demonstrates that climate is changing over the earth; however, soil impacts from climate change cannot be accurately predicted at this time. The availability and quality of groundwater resources will be affected with climate change, and the BLM adaptive management practices can provide the best strategy for meeting needs and challenges.

Total Dissolved Solids (TDS)

Total dissolved solids are comprised of salt or an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts.

The Total Maximum Daily Load (TMDL) identifies the maximum amount of a pollutant that a water body can receive and still meet water quality standards, an allocation of that amount to the pollutant's sources, and a strategy for bringing the water body back into compliance.

http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm

By removing ground cover, grazing can result in a change in runoff versus infiltration and can also change the amount of transpiration by plants. Using the BLM's Land Health Standards should alleviate these concerns (see the Livestock Grazing section for further discussion). (Also see the Surface Water Resources section below for further discussion.)

Surface Water Resources

Surface water quality in the planning area is variable due to the highly erratic discharge and highly erosive nature of the geologic parent material and soils. The planning area has streams and rivers typical of a landform derived from sedimentary deposits in the Northern Great Plains, with relatively poor quality water most of the time.

Total dissolved solids (TDS) range from 200 parts per million (PPM) at high flows to 4,000 PPM during low flows. Sodium and sulfate concentrations in the heavy clay soils and irrigation return flows contribute to an increase in the TDS levels. Major ions include calcium, magnesium, sodium, and sulfate. In late summer, TDS in small water impoundments can approach levels that are toxic for livestock and other animals. The planning area has high suspended sediment concentrations and discharges due to highly erosive soils and less resistant types of bedrocks that formed as sedimentary deposits.

Water quality standards are set by states and American Indian tribes. These standards identify the beneficial use for each water body (e.g., drinking water supply, contact recreation [swimming], and aquatic life support [fish]) and the scientific criteria necessary to support those uses. When a standard is exceeded, the particular stream is considered impaired. When the impairment is due to human sources, a Total Maximum Daily Load (TMDL) is completed.

Current Condition of Surface Water Resources

Public lands in the planning area are drained by tributaries of the Missouri River, which include the Grand, Moreau, Belle Fourche, Cheyenne, Bad, White, and Little Missouri Rivers. The SDFO manages little acreage directly on these rivers but

does manage land along streams and drainages that flow into these rivers. Approximately seven percent of riparian areas and streams in the decision area were found to be functioning at risk because of current livestock management practices.

Runoff from the ephemeral and intermittent tributaries results from snowmelt or intense summer storms. Since many of the smaller tributaries are underlain by Pierre shale or other heavy clay soils, runoff from intense rainfall is rapid and can change from zero to flood stage within a single day.

Surface runoff is often captured through reservoirs placed in drainages; however, there are no commercial or municipal uses of surface water on public lands in the planning area. In South Dakota, the BLM does not administer enough surface acreage to cause major impacts to surface water quality or quantity except for Butte County and portions of Meade County. Grazing use does occur in these two counties; if improperly managed surface water runoff can result in increased sediment or fecal coliform.
Naturally formed lakes are not present on public lands in the planning area. While small natural lakes are present in glaciated portions of eastern South Dakota, they are very rare in western South Dakota.

Springs and seeps are also not common in the planning area; the few springs and seeps that are present on public land are located in or around the Black Hills, mainly within the Exemption Area. Occasionally, a spring or seep can be found near floodplains along drainageways, but these are small and have limited potential.

Water in South Dakota is the property of the people of the state; therefore, the BLM applies for water rights to water sources on BLM land under the same regulations as all other applicants. The BLM manages the land for multiple uses and files water rights to protect these uses.

Belle Fourche TMDL Review

Although the BLM does not manage land directly along the Belle Fourche River, the following summary of the Belle Fourche TMDL Review (SD DENR 2005) provides a snapshot of riparian conditions on rangelands in western South Dakota.

A tributary of the Missouri River, the Belle Fourche River is currently listed as impaired due to a high amount of total suspended solids (TSS). The TMDL Review attributed approximately 75 percent of the suspended solids to stream entrenchment (downcutting) and bank failure, with another 20 percent resulting from irrigation and on-farm waste. Of the amount attributed to stream entrenchment and bank failure, 50 percent was thought to be coming from either natural sources or resulting from altered stream energy (including irrigation discharges); this situation is particularly the case in the eastern portion of the Belle Fourche watershed, which is dominated by reaches with high clay banks.

The other 50 percent of the suspended solids is attributed to riparian degradation, which primarily occurs where cattle have unrestricted access to the streams during the summer. According to the TMDL conceptual sediment budget, approximately 15 to 35 percent of the TSS load in the Belle Fourche River results from riparian degradation; another three to five percent results from rangeland erosion. The TMDL Review then notes that properly functioning riparian areas can significantly reduce nonpoint source pollution by intercepting surface runoff through settling, filtering, and storing sediment and associated pollutants, and by stabilizing banks.

The SDFO has been peripherally involved with the TMDL Review and watershed planning efforts in the Belle Fourche watershed; however, since most of the projects are on private land, BLM involvement has been minimal. The primary contribution the BLM has made to the review has been an annual assessment of upland and riparian conditions on public land and the subsequent changes to management that would be made if the upland or riparian standard is not met. The BLM has also cooperated with cost/share programs to implement range improvements that are designed to improve grazing management. Maintaining riparian areas in properly functioning condition is important to ensure that water quality standards are met on the public lands.

Drought, upstream activities on private land, flow control (dams), and historical alteration of the stream channel were the main reason that most Belle Fourche Watershed areas were found by the TMDL Review to be functioning either at risk or non-functioning.

Inasmuch as the primary management-related sources of water quality impairment are grazing and riparian related, we should continue utilizing the upland and riparian Standards for Rangeland Health as the primary indicators of the BLM's contribution to water quality. Relevant indicators of water quality for the Dakotas Field Offices (identified in the Standards and Guidelines for Rangeland Health (BLM 1997a) include: pH, sediment, turbidity, temperature, dissolved oxygen, fecal coliform, color, and toxins. Manageable streams should be evaluated at least every five years to ensure that conditions are maintained or moving toward desired conditions. Site-specific BMPs should be designed to improve water quality where current management actions do not appear to be producing desired results. Assessing the ecosystem function of upland and riparian areas provides the context for monitoring data that can improve the targeting of best management practices for NPS pollution, and be a leading (early) indicator for more timely decisions about aquatic habitat and water quality. Assessment of watershed function can be applied to prioritizing resources, developing indicators, monitoring aquatic habitat and water quality, and implementing adaptive management plans to restore degraded ecosystems that are producing NPS pollution (Aron, J.L., Hall, R.K., Philbin, M.J. and Schafer, R.J. 2013).
Table 3-11 lists the impaired stream segments located on BLM land in South Dakota (USEPA 2012e). The 31.8 total miles of impaired stream segments that exist on BLM land within South Dakota represent four percent of the 816.9 miles of impaired stream segments that BLM land comes into contact with.

Table 3-11
Impaired Water Bodies on BLM Land in South Dakota

Stream Segment Description with Adjacent BLM Lands	*County*	*Estimated Miles on BLM Land*	*Probable Impairment Type(s)*	*Probable Impairment Source(s)*	*TMDL*
Beaver Creek (WY border to Cheyenne River)	Fall River	0.2	Specific Conductance (TSS), Salinity, Fecal Coliform (TSS)	Nonpoint Source	No
Bull Creek (SF Grand River to S15, T21N, R5E)	Harding	0.4	Salinity (SAR^)	Natural Sources	No
Cheyenne River (Beaver Creek to Cascade Creek)	Fall River	1.9	Specific Conductance (TSS), Salinity	Crop production, riparian grazing, and natural sources	No
Cheyenne River (Fall Creek to Cedar Creek)	Fall River	1.0	Fecal Coliform, TSS	Crop production, riparian grazing, and natural sources	No
Cheyenne River (Cedar Creek to Belle Fourche River)	Meade Pennington	1.7 7.3	Alkalinity, TSS, Fecal Coliform	Crop production, riparian grazing, wildlife, and natural sources	No
Cheyenne River (Belle River to Bull Creek)	Meade	0.3	Escherichia coli Fecal Coliform, TSS	Wildlife other than Waterfowl Livestock (Grazing or Feeding Operations) Irrigated Crop Production	Yes
Crooked Creek (ND border to S34, T23N, R5E)	Harding	0.1	Salinity (SAR), Specific Conductance	Natural Sources	No
Grand River, South Fork (Jerry Creek to Skull Creek)	Harding	2.0	Salinity, TSS (Turbidity)	No causes of impairment are recorded	No
Horse Creek	Butte	2.7	TSS	Nonpoint Source; Hydrologic alteration, Irrigation practices, and riparian degradation	Yes
Little Missouri River	Harding	11.0	Salinity, TSS	No causes of impairment	No

Table 3-11
Impaired Water Bodies on BLM Land in South Dakota

Stream Segment Description with Adjacent BLM Lands	*County*	*Estimated Miles on BLM Land*	*Probable Impairment Type(s)*	*Probable Impairment Source(s)*	*TMDL*
(MT border to ND border)			(Turbidity)	are recorded	
Moreau River (North and South Forks to Ziebach/Perkins county line)	Perkins	0.3	Salinity, TSS	Natural Sources	No
South Fork Moreau River (Alkali Creek to mouth)	Butte	0.4	TSS, Specific Conductance	Natural Sources	No
Strawberry Creek (West Strawberry Creek from Headwaters to Confluence with Whitewood Creek)	Lawrence	1.7	Fecal Coliform	Nonpoint Source	Yes
White River (Pass Creek to Little White River)	Jackson Mellette	0.2 0.5	Salinity, Fecal Coliform, Escherichia coli	No causes of impairment are recorded	No
Whitewood Creek (Sandy Creek to I-90)	Lawrence	0.2	pH (High)	Natural Sources	No
Total		**31.8**			

† Total suspended solids
^ Sodium Adsorption Ratio
USEPA 2012e. South Dakota Water Quality Assessment Report [Website]. Environmental Protection Agency. http://ofmpub.epa.gov/waters10/attains_state.control?p_state=SD&p_cycle=2012

Floodplains

Floodplains receive special protection under Executive Order (EO) 11988, which directs federal agencies (including the BLM) to take action to reduce the risk of flood loss; minimize the impact of floods on human safety, health and welfare; and restore and preserve the natural and beneficial values served by floodplains. EO 11988 directs each agency to take floodplain management into account when formulating or evaluating any water and land use plans and requires that land and water resources be appropriate to the degree of hazard involved. Regulations and operating procedures for the licenses, permits, and loan or grants-in-aid programs that agencies administer are to include adequate provision for the evaluation and consideration of flood hazards. Agencies are to encourage and provide appropriate guidance for applicants to evaluate the effects of their proposals in floodplains before submitting applications for federal licenses, permits, loans or grants.

Although available since 1987, the FEMA flood maps have not been evaluated to determine the acreage defined within the 100-year floodplain demarcation. Therefore, the extent of defined 100-year floodplains occurring on BLM lands within this planning area is unknown.

Water Quality and Quantity Trends

Trends that affect surface water quality and quantity within the planning area are largely dependent on precipitation levels and activities on private land. In 2006, the State of South Dakota temporarily shut off some junior water rights holders because of lack of water in the Cheyenne River drainage. This decision reflected the current level of concern about the amount of surface water that can be made available in western South Dakota during droughts. In 2008, normal precipitation levels resumed and many large reservoirs filled to 90 to 97 percent of capacity by the early spring of 2009.

Since public land ownership is limited in the planning area, BLM activities do not usually result in dramatic changes to flow levels or the availability of surface water. Occasionally, oil or gas activities are proposed within the planning area; however, in South Dakota, these activities are limited in number and do not have large ramifications in terms of surface

water quantity or quality. Occasionally, some mining activities are proposed within the planning area. If not closely monitored, these activities could affect surface water quality.

Vegetative Communities – Rangeland, Riparian, Forest and Woodlands

Rangeland

A majority of the BLM-administered public land contains gentle rolling plains, with annual precipitation ranging from 13 to 18 inches on the prairie and 18 to 30 inches in the Black Hills. Grassland communities, indicative of the climate, are the most prevalent of all community types across the planning area. The native prairie we know today provides a diversity of heterogeneous vegetation communities across the landscape. Frequent fire intervals in the planning area also have been an important factor in maintaining healthy forests and grassland communities.

Other areas, such as those around the Cheyenne River in the southwestern part of the state, contain rugged, eroded river breaks. Badlands, buttes, alluvial fans, river terraces, stream bottoms, and flat-topped benches are also present. Major vegetation types in this area are grasslands, sagebrush grasslands, and juniper woodlands.

In the western part of the state, grasses tend to be a mixture of cool and warm season grasses common to the Northern Great Plains. The planning area is dominated by herbaceous vegetation cover with roughly 77 percent or 210,500 acres of the Decision Area within the herbaceous/non-vascular vegetation type based on GIS analysis (Landfire 2010). This vegetation type contains a large portion of the riparian areas that lack woody species and areas with shrubs where the shrubs are not the dominant life form (including sagebrush).

The GIS analysis using Landfire data from 2010 is very broad in scope with multiple vegetation types grouped together to create only five classes; herbaceous/non-vascular, shrub dominated, tree dominated, non-vegetated, and no dominant life form. The non-vegetated class primarily consists of roads and other anthropogenic features. Ponds and other water features may also show up in this class. The no dominant life form class primarily consists of badlands and other natural barren areas.

Bunch grasses grow in distinct clumps and include species such as green needlegrass (*Nassella viridula*), needleandthread (*Hesperostipa comata*), little bluestem (*Schizachyrium scoparium*), Junegrass (*Koeleria macrantha*), and Sandberg bluegrass (*Poa secunda*). Rhizomatous grasses produce shoots from lateral root systems and grow as a continuous carpet of vegetation. Common rhizomatous grasses include western wheatgrass (*Pascopyrum smithii*), thickspike wheatgrass (*Elymus lanceolatus*), and blue grama (*Bouteloua gracilis*). The vast majority of the prairie in western South Dakota is dominated by western wheatgrass.

The planning area also contains numerous forbs and several species of cacti. The most common forb families are asters, legumes, and mustards. Several species of prickly pear cacti and two species of pin cushion cacti are present. Yucca (*Yucca glauca*) is common on loamy to sandy soils, especially on ridges and river breaks.

The second most common vegetation type within the planning area is shrub dominated. The Decision Area contains roughly 14 percent or 38,500 acres of shrub dominated vegetation type (Landfire 2010). This vegetation type contains the shrubs listed in the paragraph below. Landfire 2010 also shows areas of juniper dominated river breaks as shrub dominated, where other areas of juniper show up as tree dominated. This vegetation type may also contain some riparian areas that contain willow or other woody draw and floodplain plant species.

Common upland shrubs include big sagebrush (*Artemisia tridentata Nutt*. ssp. *wyomingensis*) and skunkbush sumac (*Rhus trilobata*). Less common upland shrubs include rubber rabbitbrush (*Ericameria nauseosa*), sand sagebrush (*Artemisia filifolia*), and mountain mahogany (*Cercocarpus montanus*). Riparian areas and woody draws may contain chokecherry (*Prunus virginiana*), hawthorn (*Crataegus* spp.), buffaloberry (*Shepherdia argentea*), and sandbar willow (*Salix interior*). Floodplains often contain silver sagebrush (*Artemisia cana*) or greasewood (*Sarcobatus vermiculatus*). Woody draws and

floodplains may have such trees as boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and plains cottonwood (*Populus deltoides*).

The flora of northwestern South Dakota is unique because it contains the only extensive population of big sagebrush in the state. The shrub dominated vegetation type includes roughly 800 acres of sagebrush with at least 10 percent canopy cover of sagebrush. These areas are in Butte and Harding counties.

Common non-native vegetation includes smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), common dandelion (*Taraxacum officinale*), salsify (*Tragopogon dubius*), field brome (*Bromus arvensis*), and downy brome (*Bromus tectorum*). Field brome and downy brome are considered cheatgrass throughout this document. (Noxious weeds are discussed in detail in the Noxious Weeds and Other Invasive Non-Native Species section.)

General guidance for BLM states that native plant species should be used or managed for when practical. Seeding disturbed sites with native species is an example. The BLM's SDFO resources staff uses the "ecological site concept" to understand the potential of an area to produce different vegetation types. Ecological sites can be observed on the landscape because similar soils, climate, and other physiographic factors result in similar types of vegetation.

Plant species composition is a primary concern for BLM land managers because the abundance or decline of certain plants often indicates how land has been managed. Since soils play a major role in the types of plants present, most monitoring and inventory methods require resource specialists to consider soil types when assessing vegetation health. (See the Soil Resources section for a discussion of soil resources in the planning area.)

Vegetation Measurement

Common measurements used to document vegetation type, structure, and abundance include:

Canopy Cover: The amount of cover that the aerial portion of vegetation provides.

Density: How many and how close individual plants are to one another.

Frequency: The number of plants in a given area. Frequency is related to density.

Technical Reference 1734-4. Sampling Vegetation Attributes (BLM 1996)

When describing plant species composition, vegetation is often described in seral stages – the progressive development of vegetation from one plant community to another. Seral stages are described as early seral, mid seral, late seral, and Potential Natural Community (PNC), sometimes described as climax. Some examples are where a dry upland prairie site may eventually develop into a tall, bunch grass community, while a riparian area may develop large woody shrubs and eventually trees. PNC develops when vegetation has progressed to the fullest extent possible and the plant community continues to replace itself until some form of disturbance occurs.

The BLM may use the ecological site concept as well as production, structure, and composition to assess plant communities. In many cases, these measurements are taken at fixed points using plot frames along a measuring tape. The BLM also estimates plant biomass (see Glossary) at various sites and uses the NRCS technical guides to determine the seral stage (see previous discussion). The NRCS method involves a point system based on what type of vegetation is expected at a given site. Other indicators include plant vigor, plant distribution across the landscape, and presence/absence of noxious weeds. Forage utilization is used to determine the amount of current annual production of a plant that has been removed by grazing.

The Montana/Dakotas Standards for Rangeland Health (BLM 1997a) are the primary guidance used to assess rangeland health for uplands, riparian areas, water quality, air quality, and habitat biodiversity. Assessment protocols are obtained from the Rangeland Health Standards Handbook 4180-1 (BLM 2001) and Interpreting Indicators for Rangeland Health, Technical Reference 1734-6 (2005). Other sources used to measure rangeland vegetation include Sampling Vegetation Attributes, Interagency Technical Reference 1734-4 (1996), Utilization Studies and Residual Measurements, Interagency Technical Reference 1734-3 (1996), and BLM Rangeland Monitoring and Evaluation Handbook 4400 (1989). (See the Livestock Grazing section for further details on assessing the standards.)

The BLM Assessment, Inventory and Monitoring (AIM) strategy is currently in the process of development. The AIM Strategy addresses renewable resource data collection specific to vegetation, associated habitats for wildlife, and the supporting ecological components of soil and water. In general, the strategy is intended to: (1) document the distribution and abundance of natural resources on public lands; (2) determine resource conditions; and (3) identify natural resource

trend or change. These objectives will be accomplished through the integration of fundamental processes including the: (1) development and application of a consistent set of ecosystem indicators and methods for measuring them (i.e., quantitative core indicators and consistent methods for monitoring); (2) development and implementation of a statistically valid sampling framework; (3) application and integration of remote sensing technologies; and (4) implementation of related data acquisition and management plans (e.g., Geospatial Services Strategic Plan, Enterprise Geographical Information System architecture, and rapid ecoregional assessments). In addition, this strategy provides a path forward to systematically identify landscape-scale values and risks.

Rangeland Trends

Between 2000 and 2007, the planning area was in a drought. Although normal precipitation patterns resumed periodically during this period, a long-term drought pattern had emerged. The most noticeable changes were dry, open winters and hot, dry summers. Springtime moisture levels varied with some areas receiving above-average precipitation in some years, with other areas receiving so little moisture that a spring green-up was not apparent.

In 2007, precipitation levels began to increase across western South Dakota. Although the southern Black Hills remained in drought status in 2007 and 2008, much of the planning area was receiving average levels of spring moisture by 2008. Precipitation levels remained near average for the rest of 2008 and at or above average until the summer of 2012 when a major drought occurred again.

The majority of public land that is assessed each year by the SDFO (95 percent, or 260,000 acres of the 274,000 acre decision area has been assessed to date) meets the Standards for Rangeland Health. A majority of the areas not meeting the standards have problems as a result of introduced species such as smooth brome, noxious weeds, or cheatgrass. In some cases standards are not met due to livestock grazing. The major problem with introduced species is their tendency to produce monotypic stands resulting in the loss of native plant diversity (BLM SDFO Rangeland Health Assessments 2004-2010 and Rangeland Inventory, Monitoring, Evaluation Reports 2004-2010).

According to BLM rangeland health assessments completed since 2004, approximately 4,500 acres of the 260,000 acres assessed within the planning area did not meet Standards for Rangeland Health as a result of livestock grazing (BLM 2010b). Corrective management actions have been implemented on all grazing allotments that did not meet the Standards. Reassessment of some of the allotments not meeting Standards indicates that 3,100 acres have improved and now meet the Standards, leaving 1,400 acres still not meeting Standards due to livestock grazing. Additional monitoring will be conducted on these allotments to ensure significant progress toward meeting the Standards.

Riparian Condition Classes

Proper Functioning Condition (PFC): Referring to riparian-wetlands, properly functioning when adequate vegetation, landform, or large woody debris are present to dissipate stream energy associated with high water flows. The functioning condition of these areas is influenced by geomorphic features, soil, water, and vegetation.

Functional at Risk: Riparian-wetland areas that are in functional condition, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Nonfunctional: Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and thus are not reducing erosion, improving water quality, etc.

Technical Reference 1737-15. PFC for Lotic Areas. (BLM 1998)

Riparian

Riparian and wetland communities are more structurally diverse and produce more plant and animal biomass than adjacent uplands in the planning area. Riparian areas adjacent to flowing (lotic) and standing (lentic) water form transition zones between aquatic and upland areas and may or may not be jurisdictional wetlands. Riparian area acres have not been estimated as riparian areas are difficult to separate from the other vegetation types in the planning area. As described in the other sections, riparian areas are included mainly in the herbaceous/non-vascular vegetation type but they may occur in the other vegetation types as well.

Wetlands are determined to be present by the presence of obligate wetland species and hydric soils indicating available moisture in soil. Three types of riparian and wetland communities are present in the planning area; they are: forest-dominated riparian, graminoid-dominated (grass/sedge) wetland, and shrub-dominated riparian. See Appendix J for a list of common riparian plants in the planning area. Naturally occurring wetlands are not abundant in the

planning area; the majority of natural wetlands in South Dakota are found in glaciated areas east of the Missouri River in the eastern part of the state.

A BLM standard for riparian areas and wetlands was developed as part of the Standards for Rangeland Health (BLM 1997a) To meet the Standard, a riparian area must possess certain functional attributes and conditions; the general definition states that riparian areas need to be in Proper Functioning Condition (PFC) for site-specific conditions of climate, soils, and parent material. This standard is described by a set of indicators for the hydrologic, erosion deposition and vegetation components (BLM 1997a). These indicators were derived in part from the PFC protocol developed and published in Riparian Area Management TR 1737-15 in 1998.

The Interagency Technical Reference 1737-15 (BLM 1998) is the standard protocol for the PFC assessments in lotic areas. The stability of the system and its ability to provide for the values associated with riparian areas are the main focus of the PFC assessment method.

In 2007, the SDFO completed an extensive survey of riparian areas with additional surveys completed as the RMP planning process has progressed. Riparian areas were assessed using the PFC methodology. The PFC assessments are used by the BLM and many other federal agencies to assess the condition and capabilities of riparian systems. The assessments are also used to flag areas that require more in-depth quantitative monitoring. PFC assessments were completed on 54 miles of major riparian areas on BLM–administered land within the planning area. Of the areas assessed, the study indicated that 68 percent (or 37 miles) of riparian areas on BLM-administered lands in South Dakota are in PFC. Thirty percent, or 16 miles, are Functional at Risk (FAR) and two percent (one mile) are Non-Functioning (NF).

Capability issues are affecting a majority of the streams that were rated as FAR. Of the 16 miles rated as FAR or NF, 13 miles are not meeting PFC due to capability issues; drought, upstream activities on private land, flow control (dams), and historical alteration of the stream channel were the main reason that most areas were found to be FAR or NF within the planning area. Approximately seven percent (4 miles) of riparian areas and streams were found to be FAR because of current livestock management practices.

The Interagency Technical Reference 1737-15 (the standard protocol used; 1998) instructs observers to document other factors that are contributing to unacceptable conditions that are outside of the control of the managing agency. In most cases, the BLM in South Dakota manages a small fraction of any given stream or river system and has little control of activities that occur directly upstream or on private land. These activities can adversely affect the condition of the riparian area even if management on BLM-administered lands is excellent. Some examples of other activities that may affect the condition of riparian areas include flow control (upstream dams or dewatering), influx of weeds from other lands, mining activities, oil field discharge, roads, channelization (straightening of the stream channel), and various historical uses of the stream or wetland area.

Multiple use management places several demands on the resources associated with riparian habitat. The three most important demands are flow regulation by upstream dams, dewatering of streams by irrigation, and livestock grazing. The ability to influence flow regulation and dewatering of streams is beyond the scope of this document. However, administering grazing leases and grazing influence on riparian areas is within the scope of this document. BLM grazing lease administration can adjust livestock grazing within riparian areas to improve riparian habitat and make significant progress toward meeting the riparian rangeland health standard. Riparian areas will be a priority for BLM management. Although riparian areas make up a small percentage of the BLM land base, they are critical as habitat for numerous wildlife species such as amphibians, ground-nesting birds, waterfowl, and shorebirds. In addition, the emphasis on nonpoint source pollution (see the Glossary for a definition) will result in increased management and monitoring of riparian areas within grazing allotments that include private and public lands in the planning area.

Riparian Trends

Apparent trend was determined for stream reaches that were rated as FAR. There were just less than 4 miles of FAR streams with an apparent upward trend, 0.3 miles with an apparent downward trend, and just over 12 miles with no apparent trend. Quantitative monitoring data is not available to determine trend on FAR stream reaches at this time. Approximately four miles of stream reach assessed as FAR using the PFC method in 2007 were rated as PFC during a follow-up PFC assessment in 2010. Although livestock grazing was not considered a factor in the FAR rating in 2007, the higher PFC rating shows improved riparian conditions within the planning area.

Riparian vegetation productivity declined during the drought but has recovered with resumption of normal precipitation levels. Large-scale changes in vegetative species composition in riparian areas was not documented or observed during the drought. The occasional die off of sandbar willow was observed, but a large-scale mortality of woody species did not occur.

Salt cedar continues to be a threat in the planning area. In many cases, the increase in salt cedar has been slowed with chemical and biological treatments, but this plant continues to pose a threat to native plant communities if left untreated. The main concentration of salt cedar in the planning area is on the Cheyenne River in the southwestern part of the state. (See the Noxious Weeds section for a detailed discussion of this plant.)

Flow control (dams) may be a limiting factor for cottonwoods in many larger stream systems, as periodic high flows do not occur to the extent needed for cottonwoods to become established on the floodplains. The BLM has limited control of management that would affect flow levels, as the majority of dams are not on BLM-administered public lands, and BLM has a limited amount of surface acres in or adjacent to the larger stream and river systems.

Forest and Woodlands

Biome

A major regional or global biotic community, such as grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate.

The Black Hills is a refuge for plant species that occur in four of the North American biomes: Cordilleran Forest, Grassland, Eastern Deciduous Forest, and Northern Coniferous Forest (Marriot et al. 1999). This mixture of vegetation is a result of the varied topography, geology, and climates found within the Black Hills. Ponderosa pine (*Pinus ponderosa*) is the dominant species, occurring in dense, closed stands and open woodland. Bur oak (*Quercus macrocarpa*) and ironwood (*Ostrya virginiana*) are common along the fringe of the Black Hills. Drainages and north slopes often contain white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), beaked hazelnut (*Corylus cornuta*), and chokecherry (*Prunus virginiana*). Stands of aspen (*Populus tremuloides*) can be occasionally found. The scattered nature and inadequate accessibility of forested stands limits some management and treatment options.

Open stream bottoms and wet meadows often contain Bebb willow (*Salix bebbiana*), yellow willow (*Salix lutea*), red-osier dogwood (*Cornus sericea*), bog birch (*Betula pumila*), bulrush (*Scirpus* spp.), beaked sedge (*Carex rostrata*), woolly sedge (*Carex pellita*), rushes (*Juncus* spp.), Kentucky bluegrass (*Poa pratensis*), brookgrass (*Catabrosa aquatica*), and red top (*Agrostis gigantea*). Timothy (*Phleum* spp.), mountain iris (*Iris missouriensis*), clovers (*Trifolium* spp.), and bluegrass (*Poa* spp.) are common in drier meadows.

Ponderosa pine (*Pinus ponderosa*) transitions into mountain mahogany (*Cercocarpus montanus*) and Rocky Mountain juniper (*Juniperus scopulorum*) in the drier climate of the Southern Hills. Rocky Mountain juniper also occurs as woodlands in the river breaks and can be found scattered across steep slopes and ridges with loamy soils outside the Black Hills.

The tree dominated vegetation type is the least prevalent vegetation type within the planning area. The Decision Area contains roughly 6 percent, or 17,500 acres of tree dominated vegetation type (Landfire 2010). This vegetation type contains the tree species mentioned above. There are also areas where Landfire 2010 shows juniper dominated river breaks as tree dominated, where other areas of juniper show up as shrub dominated. This vegetation type may also contain some riparian areas that contain green ash and cottonwood.

Indicators used for evaluating the health condition of the forested ecosystems are: fire regime condition class, cover type, diversity of age classes, density of trees, and the occurrence of insect outbreaks over large areas. Stand-specific inventories are currently incomplete to describe detailed existing conditions; however, like much of the western U.S., fire exclusion has led to conditions that are not as healthy or resilient to disturbance.

Forest and Woodland Trends

The historic fire regime of low intensity fires on a 5- to 15-year cycle has been interrupted by fire exclusion. Lack of frequent, low intensity fire disturbance has resulted in a forest structure displaying increased tree density in the overstory, abundant tree regeneration in the understory, and a buildup of ground fuels (both large diameter and litter layers). In addition, cover types are changing along successional pathways. Historical oak stands, aspen stands, and open meadows have been invaded by pine (Black Hills area) or juniper/cedar (prairie woodlands), leading to more contiguous conifer coverage. White spruce is seeding in among pine in the Exemption Area. The trend results in stands that are more prone to larger and more intense wildfire. The Grizzly Gulch Fire of June 2002 is an example of such conditions in the Exemption Area. The large, intense fire caused the evacuation of the town of Deadwood, SD, during the height of the summer tourist season.
Although there is no comprehensive inventory to specifically categorize structural stages, it is likely the lack of fire disturbance is causing a less diverse array of structural stages. The Grizzly Gulch Fire reset the structural stage to establishment phase, and natural restocking will occur unless disturbed again. Excessive and undesirable stocking may be the result of unmanaged regeneration, particularly in the Wildland Urban Interface (WUI) areas.

An epidemic population of Mountain Pine Beetles has caused thousands of acres of trees in the nearby Black Hills National Forest to die. The small diameter, dense, contiguous ponderosa pine stands, along with warmer winters over the past six to seven years, has allowed the beetles to flourish. Mountain Pine Beetle risk for successful attack increases with increasing stand densities. Stand densities of more than 80 square feet basal area are at higher risk for Mountain Pine Beetle attack and mortality. Invasive and aggressive pests will continue to plague native species, and it is probable there will be new pests to be concerned about. Climate change, discussed earlier in this chapter, may cause increased stress on forests and woodlands. Cover types may change due to climate change.

The sale and housing development of Homestake Mine property in the Exemption Area (Figure 2-2) has increased the complexity of forest management by creating WUI areas and additional access problems. Expansion by the city of Sturgis may decrease opportunities for prescribed burning.

Special Status Plants

See the Special Status Species section for a discussion of Special Status Plants.

Noxious Weeds and Other Invasive Non-Native Species (Plant and Animal)

Integrated Pest Management (IPM)

An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the economical means, and with the least possible hazard to people, property, and the environment. EPA 2010. Fact Sheet

An invasive species is an alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Within the planning area, present invasive species consist primarily of exotic plant species. However, other types of organisms, such as animals and pathogens, are making their way closer to the planning area and could potentially affect activities on BLM lands within the next 20 years. Most of these species are associated with water bodies and have been designated by the State of South Dakota as Aquatic Nuisance Species (ANS). Integrated Pest Management (IPM) is the preferred method for noxious weed and invasive species control within the BLM. The BLM has and shall continue to remain active in developing, demonstrating, and applying the essential science, technology, and stewardship necessary to effectively manage and prevent the spread and infestation of noxious weeds and invasive species.

Noxious Weeds and Invasive Plants

Noxious and invasive weeds are considered the single most serious threat to natural habitats. Noxious weed invasion contributes to the loss of rangeland productivity, increased soil erosion, reduced water quantity and quality, reduced species and structural diversity, loss of wildlife habitat, and in some instances, is hazardous to human health and welfare, as

emphasized in the federal Noxious Weed Act of 1974 (PL 93-629, as amended by Section 15 – Management of Undesirable Plants on Federal Lands, 1990). Some weed species pose a significant threat to multiple use management of BLM land. South Dakota currently has designated 28 species as noxious weeds; eight species are listed as state noxious weeds and 20 species are listed as "locally noxious" within particular counties. An invasive plant attains a noxious status by legislation only. This designation usually places the burden to control, contain, or inhibit reproduction of a listed species on the owner of an infested parcel. Each county in South Dakota is allowed to designate plant species as "locally noxious" within that county. The BLM also maintains a list of exotic invasive species (refer to Glossary) for the land it administers. Table 3-12 lists both South Dakota noxious weeds and BLM invasive species found within the planning area.

Table 3-12
Noxious and Invasive Plants Occurring within the Planning Area

Common Name – Latin Name	***South Dakota Noxious***	***BLM Invasive***
Russian knapweed – *Acroptilon repens*	Statewide noxious	Yes
common burdock – *Arctium minus*	Locally noxious	Yes
Absinth wormwood – *Artemisia absinthium*	Locally noxious	Yes
field brome – *Bromus arvensis*	N/L	Yes
downy brome – *Bromus tectorum*	N/L	Yes
hoary cress – *Cardaria draba*	Statewide noxious	Yes
Plumeless thistle – *Carduus acanthoide*	Locally noxious	N/L
musk thistle – *Carduus nutans*	Locally noxious	Yes
diffuse knapweed – *Centaurea diffusa*	Locally noxious	Yes
spotted knapweed – *Centaurea maculosa*	Locally noxious	Yes
yellow starthistle – *Centaurea solstitialis*	N/L	Yes
oxeye daisy – *Leucanthemum vulgare*	N/L	Yes
chicory – *Cichorium intybus*	Locally noxious	Yes
Canada thistle -- *Cirsium arvense*	Statewide noxious	Yes
bull thistle – *Cirsium vulgare*	Locally noxious	Yes
poison hemlock – *Conium maculatum*	Locally noxious	Yes
field bindweed – *Convolvulus arvensis*	Locally noxious	Yes
houndstongue – *Cynoglossum officinale*	Locally noxious	Yes
common teasel – *Dipsacus fullonum*	N/L	Yes
Russian olive – *Elaeagnus angustifolia*	N/L	Yes
leafy spurge – *Euphorbia esula*	Statewide noxious	Yes
common St. Johnswort – *Hypericum perforatum*	Locally noxious	Yes
perennial pepperweed – *Lepidium latifolium*	N/L	Yes
dalmatian toadflax – *ssp dalmatica*	Locally noxious	Yes
yellow toadflax – *Linaria vulgaris*	N/L	Yes
purple loosestrife – *Lythrum salicaria*	Statewide noxious	Yes
Scotch thistle – *Onopordum acanthium*	Locally noxious	Yes
common reed – *Phragmites australis* subsp	Locally noxious	N/L
Giant knotweed – *Polygonum sachalinense*	Locally noxious	No
sulphur cinquefoil – *Potentilla recta*	Locally noxious	Yes
bitter nightshade – *Solanum dulcamara*	N/L	Yes
perennial sowthistle – *Sonchus arvensis*	Statewide noxious	Yes
common tansy – *Tanacetum vulgare*	Locally noxious	Yes
salt cedar – *Tamarix ramosissima*	Statewide noxious	Yes
puncturevine – *Tribulus terrestris*	Locally noxious	Yes
common mullein – *Verbascum thapsus*	Locally noxious	Yes
spiny cocklebur – *Xanthium spinosum*	N/L	Yes

N/L = Not Listed

Aquatic Nuisance Species and Other Invasive Species

The State of South Dakota has developed a management plan to address invasive species (animals, plants, and pathogens) associated with water bodies. The South Dakota Aquatic Invasive Species (AIS) list includes some plant species that are also listed as noxious. Other than a few plant species, the planning area currently is relatively free of AIS. However, suitable habitat for many AIS is present and if introduced, AIS species could affect BLM lands and their management. These AIS are categorized into two classes to help implement proper management and prevention for each species, Primary Concern and Secondary Concern as shown in Table 3-13.

Table 3-13
South Dakota Aquatic Invasive Species of Concern

Common Name (Scientific Name)	*Status Code**	*Probable Vectors***
Primary Concern		
Brittle naiad (*Najas minor*)	ES	I/BBE
Curly pondweed (*Potamogeton crispus*)	ES	I/BBE
Didymo (*Didymosphenia geminata*)	ES	BBE
Eurasian water-milfoil (*Myriophyllum spicatum*)	ES	I
New Zealand mudsnail (*Potamopyrgus antipodarum*)	NP	I/BBE
Rusty crayfish (*Orconectes rusticus*)	NP	B
Zebra mussel (*Dreissena polymorpha*)	NP	BBE
Quagga mussel (*Dreissena rostriformis bugensis*)	NP	BBE
Bighead carp (*Hypothalmichthys nobilis*)	NP	AE
Black carp (*Mylopharyngodon piceus*)	NP	I/B
Common carp (*Cyprinus carpio*)	ES	I/B
Grass carp (*Ctenopharyngodon idella*)	ES	I
Silver carp (*Hypothalmichthys molitrix*)	ES	AE
VHS (*Viral hemorrhagic septicemia*)	NP	I/BBE
Secondary Concern		
Black alder (*Alnus glutinosa*)	NP	I
Brazilian waterweed (*Egeria densa*)	NP	
Bur reed (*Sparganium glomeratum* (Laestad.) L. Neum)	NP	
European water clover (*Marsilea quadrifolia*)	NP	I
Flowering rush (*Butomus umbellatus*)	ES	I/PT
Purple loosestrife (*Lythrum salicaria*)	ES	I/PT
Salt cedar (*Tamarix* spp.)	ES	I/PT
Water foxtail (*Alopecurus arundinaceus*)	ES	
Yard dock (*Rumex longifolius* DC.)	NP	
Yellow floating-heart (*Nymphoides peltata*)	NP	AM
Yellow iris (*Iris pseudacorus*)	ES	PT
Asian clam (*Corbicula fluminea*)	COL	B/AE
Big-ear radix (*Radix auricularia*)	NP	PT/AM
Calanoid copepod (*Megacyclops viridis*)	NP	BBE
Chinese mystery snail (*Cipangopaludina chinensis malleata*)	NP	AM
European stream valvata (*Valvata piscinalis*)	NP	BBE
Freshwater jellyfish (*Craspedacusta sowerbyi*)	NP	I/PT
Japanese mystery snail (*Cipangopaludina japonica*)	NP	I
Opossum shrimp (*Mysis relicta*)	ES	I
Snail (*Melanoides tuberculata*)	ES	BBE
Spiny water flea (*Bythotrephes longimanus*)	NP	I/BBE
Water flea (*Daphnia lumholtzi*)	NP	BBE
Water flea (*Eubosmina coregoni*)	NP	I
Alewife (*Alosa pseudoharengus*)	NP	I
Bowfin (*Amia calva*)	NP	
Brook silverside (*Labidesthes sicculus*)	NP	I/B
Bullhead minnow (*Pimephales vigilax*)	ES	I

Table 3-13
South Dakota Aquatic Invasive Species of Concern

Common Name (Scientific Name)	*Status Code**	*Probable Vectors***
Cisco (*Coregonus artedi*)	ES	PE
Digenean fluke (*Ichthyocotylurus*)	NP	PE
Digenean fluke/trematode (*Neascus brevicaudatus*)	NP	AM
Goldfish (*Carassius auratus*)	ES	I
Lake chubsucker (*Erimyzon sucetta*)	NP	PE
Monogenetic fluke (*Dactylogyrus amphibothrium*)	NP	PE
Monogenetic fluke (*Dactylogyrus hemiamphibothrium*)	NP	I
Myxosporidian (*Sphaeromyxa sevastopoli*)	NP	B
Nutria (*Myocastor coypus*)	NP	BBE
Redside shiner (*Richardsonius balteatus*)	NP	B
Round goby (*Apollonia melanostomus*)	NP	BBE
Rudd (*Scardinius erythrophthalmus*)	ES	I
Ruffe (*Gymnocephalus cernuus*)	NP	I
Sacramento perch (*Archoplites interruptus*)	ES	I
Salmonid whirling disease (*Myxobolus cerebralis*)	NP	I/BBE/B
Tench (*Tinca tinca*)	NP	BBE
Three-spined stickleback (*Gasterosteus aculeatus*)	NP	I
Tubenose goby (*Proterorhinus semilunaris*)	NP	I
Western/Eastern mosquitofish (*Gambusia affinis/G. holbrooki*)	NP	I
White catfish (*Ameirus catus*)	NP	
Zander (*Sander lucioperca*)	ES	

*Status Codes: established (ES), not present (NP), collected (COL).
**Probable vectors by which species were or may be introduced: intentional planting or stocking (I), boat-barge equipment (BBE), bait (B), aquaculture (AE), plant trade (PT), aquarium (AM), and parasite (PE).

While poisonous plants are present in South Dakota, BLM rarely receives complaints about poisonous plants other than an occasional complaint about human contact with poison ivy or stinging nettle and on some occasions, impacts to livestock from consumption of a poisonous plant. The most common poisonous plants in the planning area are poison hemlock, water hemlock, poison ivy, death camas, poison vetches, stinging nettle and woolly locoweed. In most cases, these plants are not grazed by livestock in sufficient quantities to cause problems. Poisoning of humans is possible if a poisonous plant is mistaken for a plant that is normally consumed for food, but there are no records of this occurring on BLM-administered lands. Generally poisonous plants are not a major concern on BLM-administered lands in the planning area.

Factors Affecting Noxious Weeds and Other Non-Native Species

Long-term monitoring indicates invasive species are generally spreading from 10 to 25 percent annually on public lands. This range is variable because trend data reflects the increased resources over time in locating invasive species rather than new increases in overall infested area due to dispersion.

Factors that affect invasive species include natural and anthropogenic pathways and disturbance mechanisms. Their ability to spread is not always associated with proximity to established infestations. Natural processes that contribute to the spread of invasive species include fire, flooding, ice scouring in streams, drought, wind, and wildlife. Construction activities (roads, wells, and pipelines), recreation, and agricultural uses also contribute to the spread of invasive species. 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 adverse impacts and the spread of invasive species in the planning area.

Insect Pests

The gypsy moth (Lymantria dispar) is a state declared pest. Gypsy moth larvae generally prefer oaks, but may feed on several hundred different species of trees and shrubs, both hardwood and conifer (SDDA SD 2014 at http://sdda.sd.gov/ag-

services/weed-and-pest-control/weed-pest-control/sd-state-noxious-weed-declared-pest-list-and-distribution-maps/gypsy-moth/default.aspx).

The mountain pine beetle (Dendroctonus ponderosae) is a locally declared pest. This small insect lives most of its life in the inner bark of pine trees. They fly from infested trees to new host trees in late June or July. Once they have located a favorable living host pine, the adults tunnel beneath the bark to lay eggs. The beetles can colonize trees in large numbers. The tunneling beneath the bark by the adult beetles and their larvae harms the tree by disrupting the movement of food, produced by the needles, to the roots. The adult beetles also can carry a blue-stain fungus from tree to tree. This fungus stops the movement of water from the roots to the needles. The combination of these two factors results in the tree's death (SDDA SD 2014 at http://sdda.sd.gov/conservation-forestry/forest-health/mountain-pine-beetle/identification-biology/). Protection measures can be found at http://sdda.sd.gov/conservation-forestry/forest-health/mountain-pine-beetle/management-strategies-for-the-mountain-pine-beetle/. Additional information on insect pests that attack trees can be found in the forestry portion of the Vegetation section in this chapter.

Wildlife

The planning area falls within the Northern Great Plains ecosystem and hosts an array of diverse habitats which in turn support numerous species of wildlife. Sagebrush steppe is at the easternmost edge of its range in western South Dakota, and midgrass prairie in the western and central parts of the planning area transitions to tallgrass prairie in the east. River breaks, badlands, buttes, and the Black Hills provide topographical diversity in the landscape. Diversity in landscape allows for diversity in wildlife in the planning area, and where certain habitat resources are limited, species that rely on those resources are often of special concern.

Presence of any species may be seasonal or year-round based on individual species requirements. Wildlife found in the planning area are representative of those occupying habitat types of the Northern Great Plains ecosystem, including grassland, sagebrush, woodland, and riparian habitats. Sagebrush habitats provide perennial habitat for such iconic species as mule deer, sage-grouse, and pronghorn antelope (*Antilocapra americana*), as well as for a suite of small and less charismatic wildlife. Ponderosa pine, juniper, and hardwood draws provide nesting sites for a variety of bird species commonly found in more timbered areas. More than 400 species of birds may be observed in the planning area with statuses ranging from common to accidental (Tallman et al. 2002).

Grasslands and grassland/ shrublands are the dominant vegetative types, with grasslands generally more abundant to the east and sagebrush more abundant to the north and west. Grasslands and grassland/shrublands cover 97 percent of BLM surface acres. Sagebrush provides crucial winter range for big game and is essential for sage-grouse and other sagebrush-associated species such as the Brewer's sparrow (*Spizella breweri*). Many other species use sagebrush and associated vegetation, including a number of reptiles, amphibians, small mammals, and invertebrates. Other shrubs such as greasewood, chokecherry, and wild rose provide important forage, hiding areas, or thermal cover for a variety of wildlife, including deer and sharp-tailed grouse (*Tympanuchus phasianellus*), migratory birds, and small mammals.

Forests and woodlands are less abundant; however, they add structural and biological diversity to the landscape. About 7,000 acres of ponderosa pine forests and juniper woodlands are located mostly in the Black Hills, uplifts in Harding County, and the river breaks of the Cheyenne River (approximately three percent of BLM surface acres in the planning area). Forests are mainly dry-mesic montane mixed conifer forests of ponderosa pine and white spruce with scattered birch and aspen groves. The juniper woodlands that are present in the Cheyenne River and Missouri breaks contain mostly scattered trees intermixed with other shrubs and grasses. Forest and woodlands provide cover for big game (e.g., deer, elk, and mountain lions), and provide habitats for a suite of birds and small mammals. Lewis's woodpecker (*Melanerpes lewis*), black-backed woodpecker (*Picoides arcticus*), three-toed woodpecker (*Picoides tridactylus*), and Townsend's solitaire (*Myadestes townsendi*) are species which may be found in forest, woodland, or forest edge habitats (Tallman et al. 2002), and some of these species are of special conservation concern (Table 3-16).

Riparian and wetland habitats are used extensively by wildlife, including neotropical migratory birds (species that breed in North America and over-winter in Central and South America) such as finches, warblers, thrushes, and orioles. Numerous amphibian and reptile species also rely on healthy riparian and wetland habitats for all or parts of their life-stages. Buttes

and rock areas are used by golden eagles and prairie falcons, as well as by many other bird and bat species. In an open prairie landscape bats may seek out rock formation and buttes as roost sites, for maternity colonies, and as hibernacula. These areas also provide important cover for mammals such as mountain lions (*Puma concolor*), bobcats (*Lynx rufus*), and other small mammals such as ground squirrels, rabbits, and marmots.

Riparian and wetland vegetative types occur on less than two percent of the BLM surface lands; however, it is estimated that 70 to 85 percent of the wildlife use riparian habitats for at least a portion of their life cycles. Many amphibian species, as well as beaver (*Castor canadensis*), mink (*Mustela vison*), and various waterbirds and waterfowl occur in riparian or wetland areas only. Songbirds are attracted to the structural and vegetative diversity for both nesting and migration habitat.

South Dakota Game, Fish and Parks have developed and periodically update management plans for various species. Current plans include bald eagle (*Haliaeetus leucocephalus*), interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), black-tailed prairie dog (*Cynomys ludovicianus*), Topeka shiner (*Notropis Topeka*), pallid sturgeon (*Scaphirhynchus albus*), bats, aquatic nuisance species, resident Canada goose (*Branta canadensis*), mountain lion, bighorn sheep (*Ovis Canadensis*), pronghorn (*Antilocapra americana*), river otter (*Lontra canadensis*), prairie grouse (sharp-tailed grouse and greater prairie chicken), ring-necked pheasant (*Phasianus colchicus*), and sage-grouse. The All Bird Conservation Plan addresses birds in general throughout South Dakota. These plans are available at http://gfp.sd.gov/wildlife/management/plans/default.aspx. A short description of each plan is listed in Chapter 1 under the Related Plans section.

Wildlife Habitat

Historical conditions for biological resources are a function of the interaction of physical factors (e.g., climate, soils, geology, and elevation) and disturbance factors (e.g., fire, grazing, and drought). These physical and natural factors combined to produce the biological diversity present in the planning area before widespread changes occurred as a result of Euro-American settlement. Early explorers noted that wildlife resources were exceptionally abundant. Human actions during the subsequent 200 years substantially changed the pattern, composition, structure, and function of plant and animal communities. General habitat types on BLM-administered lands in the planning area are shown in Table 3-14.

Table 3-14
General Habitat Types on BLM Surface in the Planning Area

Habitat Type	***Acres***
Grasslands	210,500
Shrublands	38,500
Forest and Woodlands	17,500

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 et al. 2004). This conversion was facilitated by the Homestead Act of 1862 in the United States. Under this Act, nearly 1.5 million people acquired and plowed more than 309,000 square miles of land, primarily in the Great Plains. The impacts of land conversion in the late 1800s and early 1900s were greatest in the tallgrass portion of the Great Plains in eastern South Dakota.

Much of the direct habitat loss from conversion to agriculture has occurred in the eastern portion of the planning area. The conversion of native habitats continues throughout the area and may increase as other crops are modified to grow in more arid environments and as the demand for biofuels grows.

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 of and/or isolates remaining habitat patches below the size thresholds necessary to support components of biological diversity or blocks movement of animals between habitat patches.

As blocks of habitat are repeatedly dissected into smaller blocks, adverse impacts, including isolation, can occur to individual plant and animal species and communities. The impacts of habitat fragmentation to biological resources can

occur on multiple scales and varies by species and type of fragmentation. Individual species have different thresholds of tolerance for fragmentation. Large birds such as eagles have large territory requirements and may be able to use habitat fragments smaller than their territory, while smaller birds may require habitat areas larger than their territories (Davis 2004).

Linear features, including roads, railroads, trails, irrigation systems, and ROWs, fragment wildlife habitat in the planning area. Interstates 90 and 29, along with a network of federal and state highways, county roads, local roads on private and public lands, and the Burlington Northern and Dakota, Minnesota, and Eastern railroads dissect much of the planning area. The development of irrigation and flood control reservoirs such as the Oahe, Sharpe, Francis Case, Lewis and Clark, Shadehill, Orman, and Angustora reservoirs and their associated water distribution systems has also contributed to habitat fragmentation in the planning area. Some fences can also fragment habitats by blocking dispersal or migration routes for some wildlife species such as pronghorn (Poor et al. 2014).

Changes in vegetation can also fragment native habitats. Irrigation water has supported the conversion of native plant communities to hayfields, pasture, and cropland, thereby fragmenting habitats for some native species. Roads and off-highway vehicle (OHV) use can promote the spread of noxious weeds through vehicular traffic, and noxious weed infestations can further exacerbate the fragmentation effects of roadways. The conversion of acreages of sagebrush to predominately grassland communities can fragment habitat for sagebrush-dependent species such as sage-grouse.

Recent interest in biofuel production on private lands has resulted in an increase in the conversion of grasslands, further emphasizing the importance of BLM lands for the maintenance of blocks of native grasslands and shrublands. Habitat fragmentation is most obviously due to the linear features identified in the previous discussion; however, fragmentation also occurs at population centers and other developments where humans live, recreate, and work. Developing private parcels and subdivisions or smaller ranchettes and associated buildings, roads, fences, and utility corridors has also contributed to habitat loss and fragmentation. Another threat to habitat continuity is the recent interest in renewable energy, especially wind energy, in the planning area.

The 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. Global climate changes may affect profound changes in drought occurrences, but the degree of impact and specific changes within the planning area are currently difficult to ascertain. Productivity of native grasslands in the Northern Great Plains is highly dependent on early spring soil moisture and winter/early spring precipitation patterns, and changes in the seasonality of precipitation will have large impacts on these vegetation communities (Hatfield 2008).

In some sites within the planning area, land use activities such as agriculture, renewable energy and 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:

- improper 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;
- fire suppression, which has depleted or completely removed the natural fire regime with which habitats evolved;
- improper OHV use, which has spread invasive weeds and disturbs wildlife;
- intensive recreational activities have disturbed habitat use; and
- road placements, which have contributed to habitat fragmentation.

(See other sections of Chapter 3 which 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 widespread decline of any group of birds in North America (Knopf 1994). In addition, black-tailed prairie dogs have been reduced to about two percent of their former numbers (Kotliar et al. 1999, and references therein), and the associated black-footed ferret was thought extinct until a small population was found in Wyoming in 1981. (See the Special Status Species section for a detailed discussion.)

The changes to native habitats noted above have also benefited some species of wildlife. Ring-necked pheasants, gray partridge (*Perdix perdix*), and wild turkey (*Meleagris gallopavo*) have been introduced to the planning area and have responded positively to the changes in their habitat. They 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 they presumably were in the past.

Habitat management challenges to the SDFO include:

- the maintenance of heterogeneity in habitat composition and structure for grassland and shrubland communities;
- habitat fragmentation;
- invasion and spread of exotic species and noxious weeds;
- lack of a natural fire regime (although this should be tempered by a potential increase in exotic grass species occurring after 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 grassland and shrubland communities sufficient to support wildlife, special status species, livestock, and other competing multiple-use demands on BLM-administered lands.

Mammals

The planning area provides habitat for approximately 70 species of mammals. Many species are small terrestrial mammals such as porcupines (*Erethizon dorsatum*), rabbits, squirrels, ground squirrels, pocket gophers, mice, voles, and shrews, along with several species of bats which are not as visible but play an important ecological role in their associated habitats. The planning area also provides habitat for many species of medium-sized mammals, including coyote (*Canis latrans*), red fox, bobcat, badger (*Taxidea taxus*), beaver, and raccoon, which are the main furbearers with a role in contributing to the economics within the planning area. Other species of small furbearers, such as skunks, mink, muskrat (*Ondatra zibethicus*), and weasels, are not as visible or as economically valuable, but they do play an important ecological role in their associated habitats. The larger mammals, mainly big game including elk (*Cervus elaphus*), white-tailed deer, mule deer *(Odocoileus hemionus*), pronghorn, bighorn sheep, and mountain lions, are much more visible and play a larger role in contributing to the economics of the planning area.

Big Game

Mule deer, white-tailed deer, and pronghorn are the most common big game animals occupying much of the planning area. The sagebrush areas, mainly in Butte and Harding counties, riparian habitats, upland woodlots, river breaks, and mixed grass rangelands found on BLM lands also provide important big game habitats and are very important winter range areas for pronghorn, mule deer and game birds. Other big game species in the planning area include elk, bighorn sheep, mountain lion, mountain goat, and an occasional moose (*Alces alces*).

Mule deer are widespread in South Dakota west of the Missouri River, and are typically associated with the more open landforms that support a wide variety of sagebrush, juniper, and herbaceous vegetation. They also use the riparian stringers and woody draws, and are frequently associated with meadow and riparian habitat. Mule deer tend to be present yearlong where public land adjoins cultivated farmland.

Based on South Dakota Game, Fish and Parks (SDGFP) survey data, mule deer numbers are currently depressed relative to historic numbers. Severe winters, drought, and other biological factors have contributed to fluctuations in their numbers. Deer are generally classified as browsers, and forbs and shrubs make up the bulk of their annual diet. Woodland and rangeland management actions all have the potential to influence mule deer cover and forage. Healthy sagebrush communities are important habitats for mule deer, and open grasslands and riparian areas provide important forage and water, especially during the summer and fall.

White-tailed deer, found throughout all of South Dakota, are typically associated with river bottoms, riparian stringers, and woody draws. The white-tailed deer population is increasing across the planning area and fluctuates mainly because of disease and weather-related issues.
Seasonal habitats typically include riparian features such as rivers or streams. These habitats contain diverse vegetation that includes herbaceous forage throughout the year. Forage crops and crop residue provide the bulk of feeding areas, with browse becoming increasingly important during the winter.

Pronghorn antelope are distributed throughout much of the western half of the planning area. During summer, pronghorn antelope are widely distributed throughout the grassland and sagebrush steppe habitats. Rangelands with a mixture of grasses, forbs, and shrubs provide the best habitat (Yoakum 1972). The sagebrush community is used for both thermal cover and forage. On BLM-administered lands some existing woven wire, barbed wire fences with bottom wire less than 16 inches from the ground, and other non-wildlife friendly fences, are major movement barriers to pronghorn, especially in winter. Construction specifications for new BLM fences allow for freedom of movement for pronghorn by spacing the bottom wires at least 16 inches from the ground. The SDGFP has established population management objectives for pronghorn.

Elk populations exist within the planning area and have expanded their range in recent years, with an established population in the Black Hills and adjacent ponderosa pine/grassland areas. Elk in this area use much of the same habitat season-long and are primarily grazers, opportunistic consumers of forbs, and browsers of aspen and other tree vegetation.

Bighorn Sheep: Audubon bighorn sheep historically occupied parts of South Dakota but were thought to be extirpated in the 1910s. The first introduction of Rocky Mountain bighorn sheep occurred in 1922 in the Black Hills, but these sheep were eliminated by disease. Present day sheep herds in the Black Hills and Badlands are from various introductions, primarily occurring in 1964 and 1991. In 1964, bighorn sheep from Wyoming were transplanted into Custer State Park and sheep from Colorado were transplanted into the Badlands National Park. In 1991, 26 bighorn sheep from Colorado were released in Spring Creek Canyon in the Black Hills. The most recent transplant occurred in 2014 when 40 bighorn sheep were brought from Montana for release in Hell Canyon near Custer, SD and in the South Unit of Badlands National Park. This transplant was to augment current herds to boost genetic diversity. The 40 bighorns were split evenly between the two release locations. SDGFP has plans to introduce more bighorn sheep from Montana or Canada into certain areas of the Black Hills when time and resources allow. All of the Rocky Mountain bighorn sheep presently living in South Dakota are from introductions (Wild Mammals of South Dakota 2002). Currently there are 875 acres of BLM surface estate in bighorn sheep range in South Dakota.

Mountain lions are most likely to be found in the Black Hills and on BLM lands therein. However, mountain lions are adaptable to a variety of cover types and landscapes, and individuals are known to disperse many miles from a population source. Mountain lions hunt by ambushing prey, and rely on an element of surprise when hunting. Sufficient cover provided by some combination of terrain and vegetation, and a sufficient prey-base are necessary components of mountain lion habitat. Prey species include numerous small mammals and birds, as well as deer and other large game.

Other big game species include mountain goat (*Oreamnos americanus*) and an occasional moose. Neither of these species is likely to occur on BLM-administered lands.

Seasonal and spatial protective stipulations are currently applied around identified seasonal habitat use areas to afford big game a certain level of protection from human disturbance and industrial activities.

Pronghorn Antelope Photo by John Carlson

Habitat management challenges for big game include:

- habitat degradation (particularly browse forage), fragmentation, and loss;
- incompatible land use practices (land conversion, industrial activities, and intensive recreational activities);
- incompatible stock (domestic sheep grazing in or near bighorn sheep habitat); and
- impacts from human disturbance during sensitive periods and barriers to animal movement.

Birds

About 414 species of birds have been observed in the planning area. A variety of habitats provide important breeding, wintering, and migration habitats for many of these species, although some species are rarely found. Grassland-associated species are declining in most parts of their range and are included in a number of special status species lists (See the Special Status Species section) at the state and national levels (Tallman et al. 2002).

A number of management plans related to birds have been developed. The South Dakota All Bird Conservation Plan (Bakker 2005) contains conservation actions for South Dakota's birds. The North American Waterfowl Management Plan (NAWMP), developed in 1988 because of the decline in waterfowl production in the United States and Canada, has been divided into various joint ventures for implementation, with the Northern Great Plains Joint Venture (NGPJV) and the Prairie Potholes Joint Venture (PPJV) encompassing most of the planning area. A number of bird-associated projects related to waterfowl have been implemented with these joint ventures. The PPJV completed an implementation plan in 2005 and NGPJV completed an implementation plan in 2006, which outlines work to be completed for a variety of bird species in addition to waterfowl. A number of bird-associated projects related to waterfowl have been implemented with this joint venture. In addition, the BLM has a Memorandum of Understanding with the USFWS that provides coordination and cooperation between the two agencies.

Other related bird management plans include the North American Landbird Conservation Plan (Rich et al. 2004), the United States Shorebird Conservation Plan (Brown et al. 2001), and the North American Waterbird Conservation Plan (Kushlan et al. 2002).

Colonial Waterbirds

Thirty-three species of colonial (nesting in large colonies) and semi-colonial species of waterbirds nest in the planning area. They include double-crested cormorants (*Phalacrocorax auritis*), great blue herons (*Ardea herodias*), black-crowned night-herons (*Nycticorax nycticorax*), ring-billed gulls (*Larus delawarensis*), California gulls (*Larus californicus*), and common terns (*Sturna hirundo*) along with other egrets, grebes, and shorebirds.

In addition, interior least terns, black terns (*Chlidonias niger*), Franklin's gulls (*Larus pipixcan*), American white pelicans (*Pelecanus erythrorhynchos*), and white-faced ibis (*Plegadis chihi*) are colonial waterbird BLM species of concern found here. These birds are important because they nest in large colonies in limited areas and are highly vulnerable to habitat changes and disturbances to their breeding colonies.

Current management actions focus on protecting these colonies from human disturbance (Kushlan et al. 2002). The wetland/water-associated habitats on which they depend are maintained through wetland-specific management.

Habitat management challenges for colonial waterbirds include protecting habitat from degradation and loss and minimizing human disturbance.

Game Birds

Upland game bird species are the most popular game birds in the planning area and, until 2013, all have been hunted in parts of this area. 2013 was the first year in the past decade that SDGFP revoked the 2-day hunting season on sage-grouse. The sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), and sage-grouse, along with the greater prairie-chicken (*Tympanuchus cupido*) and mourning dove (*Zenaida macroura*), are the native upland game birds to

the planning area. Other upland game birds that have been introduced to the planning area are Merriam's wild turkey, ring-necked pheasant and gray partridge (*Perdix perdix*).

Sharp-tailed grouse occur in grassland, shrub, riparian, and woodland habitat types and often use agricultural lands where they coincide with native vegetation. Woody draws and woodlands containing silver buffaloberry, snowberry, juniper, and wild rose are used extensively for food and cover during the winter. Sharp-tailed grouse continue to be of concern due to increasing fragmentation of their habitat, habitat changes due to loss of silver buffaloberry, and disturbance from resource uses.

Greater prairie-chickens occur primarily in grassland areas with some intermingled cropland, but use several different habitats throughout the year to meet their seasonal needs. In addition to the critical food and cover that native prairies provide, interspersed croplands, wetlands, and shortgrass areas are necessary to ensure that adequate resources are available. Greater prairie-chickens also use moderately grazed native prairies and planted native grasses or ungrazed fields of cool-season grasses for nesting and winter roosting. They use slightly weedier pastures, idled crop fields, and alfalfa for brood rearing. They rarely use heavily grazed cool-season grasses except for courtship. Greater prairie-chickens also avoid idle native grasses that are too tall and dense.

Ruffed grouse are found in the Black Hills in and around stands of quaking aspen. The buds and catkins of aspen are an important food source for ruffed grouse, though they also eat a variety of other tree buds, berries and seeds. Male ruffed grouse can be heard drumming in the spring as they perform their courtship display and warn other males of their territory.

Greater Sage-Grouse (sage-grouse) populations are dependent on sage habitats with forbs. (See the Special Status Species section for further discussion on sage-grouse.)

Ring-necked pheasants were introduced into South Dakota in the 1880s and have become well established. They occur primarily where there are grain crops for food, shrubs and trees for cover, and cattail and bulrush in wetland areas for winter cover.

Gray partridge, which were introduced to the area in the 1920s, occur throughout most of the planning area and are associated with most vegetation types and agricultural lands. They feed primarily on small grain crops but do consume forbs during the summer.

Eastern wild turkeys were native to South Dakota and were extirpated from the state before 1920. In the late 1940s, Merriam's subspecies was introduced into the Black Hills, and the Eastern subspecies was reintroduced successfully in 1990. The establishment and maintenance of wild turkey populations is dependent on the presence of mast crops for food adjacent to areas with large roosting trees.

Mourning doves are migratory and also common in the planning area and are adaptable to a wide variety of habitat disturbances.

Current management actions focus on avoiding disturbance to game bird species and the seasonal habitats upon which they depend. Seasonal and spatially-protective stipulations are currently applied around identified lek sites and seasonal habitats to afford protection from human disturbance and industrial activities.

Habitat management challenges for game birds include habitat degradation (loss of important forage shrubs, nesting cover, and invasive, exotic vegetation), fragmentation, and loss; human disturbance during sensitive periods; and incompatible land use practices (land conversion, industrial activities, and intensive recreational activities).

Yearly populations of these game bird species fluctuate greatly, primarily due to weather such as drought, extreme heat, and/or wet and severe winters. Most of these species have the ability to produce large broods of young and re-populate rapidly when favorable conditions occur with quality habitat available. Populations in the planning area are currently healthy and provide recreational opportunities that contribute to local economies during the various hunting seasons.

The quality of upland game bird habitat depends on the availability of mixed shrubby and herbaceous vegetation types for nesting, brood rearing, foraging, and thermal cover. Riparian habitat plays an important role as a food source and for water and shelter for most of these species.

Migratory Birds

The planning area supports more than 250 migratory bird species. Populations of some of these species are declining as a consequence of land use practices and other factors in their summer and/or winter ranges. Migrants exhibit quite variable habitat requirements and are found in most habitat types. Most birds found in the planning area are, or have the potential to be, migratory birds except such birds as pheasant, turkey, grouse, and partridge.

Neotropical Migratory Birds

A neotropical migratory bird is a bird that breeds in Canada and the United States during our summer and spends their winter in Mexico, Central America, South America, or the Caribbean islands. (Smithsonian 2010 Factsheet)

Nearly all species of birds in the planning area are protected by the Migratory Bird Treaty Act of 1918. Further emphasis on migratory birds was enacted by Executive Order 13186 which, in part, instructed federal agencies to consider migratory birds, especially special status species, in any environmental review process.

In addition to the sensitive species already mentioned, many species of migratory birds occur throughout the planning area and breed along the riparian corridors or in forested landscapes. The planning area provides important stopover habitat for other migrants, including many special status species migrating through the area in the spring and fall on their way to and from breeding habitats.

Current management actions focus on avoiding destruction and disturbance of breeding habitats and nesting locations, primarily from surface-disturbing activities. Other management actions such as the implementation of Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) have benefited a variety of migratory birds, particularly those species associated with grasslands and shrublands. (See the Special Status Species section for further discussion.)

Similar to management challenges for game birds, management challenges for migratory birds include habitat degradation, fragmentation, and loss from exotic and invasive plants; lack of riparian structure and diversity; and incompatible land use practices (e.g., land conversion, snag removal, industrial activities, and intensive recreational activities). Other challenges include impacts from human disturbance during sensitive periods, collision with power lines, and avoidance of and collision with wind turbines.

Raptors

Approximately 25 species of raptors use the planning area during migration and as breeding habitat. Raptors (predatory birds such as hawks, eagles, owls, and falcons) can be found throughout much of the area.

Common breeding species include the red-tailed hawk (*Buteo jamaicensis*), prairie falcon (*Falco mexicanus*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), great-horned owl (*Bubo virginianus*), and long-eared owl (*Asio otus*). Other sensitive and less common breeding species that may be found locally include the ferruginous hawk (*Buteo regalis*), bald eagle, golden eagle (*Aquila chrysaetos)* and burrowing owl (*Athene cunicularia*). Nesting habitats are found in cottonwood, ash, and ponderosa pine trees, and buttes. Burrowing owls rely on other burrowing species, especially black-tailed prairie dogs, to excavate burrows in which the owls take up residence, and northern harriers nest on the ground in grasslands or marshes. Nesting substrate of burrowing owls includes prairie dog and badger burrows. Ferruginous hawks are also known to nest on rock outcrops or other prominent landscape features in lieu of trees. Prey species are more likely to be available for a wide range of raptors when plant communities are structurally diverse and support mixtures of grasses, forbs, and shrubs. Some of the breeding species are year-long residents and winter within the planning area; however, the rough-legged hawk (*Buteo lagopus*) only uses the planning area for its wintering grounds.

The open grassland, sagebrush, forest and shrubland vegetative types are home to many raptor species. Raptors are attracted to the abundant prey, including upland game birds, small game, and numerous rodent species. Seventeen diurnal raptor species and 12 owl species are known to occur in the planning area, eight of which are BLM sensitive species. (See the Special Status Species section for further discussion.)

Seasonal and spatial protective stipulations are currently applied around identified nest sites to afford raptors a level of protection from human disturbance and industrial activities.

Habitat management challenges for raptors include habitat degradation, fragmentation, and loss; lack of cottonwood regeneration; collision with and/or electrocution from power lines; collision with wind turbines; and incompatible land use practices (land conversion, snag removal, industrial activities, intensive recreational activities, and removal of burrowing mammals). Other challenges include impacts from contaminants such as lead poisoning and rodent control chemicals and human disturbance during sensitive periods.

Waterfowl

Approximately 70 species of waterfowl and shorebirds use planning area wetlands during migration and as breeding habitat when surface water is present. Representative breeding species include the Canada goose, mallard (*Anas. platyrhynchos*), gadwall (*A. strepera*), American avocet (*Recurvirostra americana*), and Wilson's phalarope (*Steganopus tricolor*). Vegetation cover for nest concealment from predators and for protection from other disturbances is important to these species during the breeding season.

Natural potholes and reservoirs are crucial for nesting waterfowl, with reservoirs becoming increasingly important during dry years. Waterfowl depend primarily on cover in upland areas and on islands in the spring for successful nesting. Quality breeding habitat for most waterfowl species includes dense nesting cover sufficiently close to water bodies which support emergent vegetation and an abundant food supply of aquatic insects for ducklings. Manmade islands that provide security from predators during nesting have been constructed in many reservoirs and are important to Canada geese, some duck species, and many other wetland-associated birds. Diving ducks, such as Canvasbacks and Redheads, also require open and deep water that supports fish and aquatic insects. Dabbling ducks, such as mallards and teal, require migration and winter habitats with a mix of open water for loafing and emergent vegetation for food and cover.

Major rivers, such as the Cheyenne, Belle Fourche, Grand, Little Missouri and Moreau, also provide waterfowl habitat. Canada geese, mallards, American widgeon (*A. americana*), and wood ducks (*Aix sponsa*) are the primary species nesting on the rivers. Canada geese primarily nest on river edges and islands. The largest number and variety of waterfowl occur during fall and spring migrations when the birds forage in harvested grain fields and marshes away from the rivers and return to the rivers for roosting and cover.

Current and past management actions have focused on creating and enhancing reservoirs and nesting islands. Annual waterfowl production has increased due to construction and enhancement of these reservoirs and nesting islands. Other management actions such as implementation of Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) have benefited waterfowl, primarily through the increase in residual cover in nesting areas.

Management challenges for waterfowl include habitat degradation through the loss of upland cover surrounding breeding areas and habitat fragmentation and loss of habitat from exotic and invasive plants; lack of riparian structure and diversity; and incompatible land use practices (e.g., land conversion, snag removal, industrial activities, and intensive recreational activities. Many productive waterfowl wetlands are frequently dry but can produce good numbers of waterfowl when water conditions are favorable.

Amphibians and Reptiles

Little is known of most amphibians and reptiles in the planning area, but they do constitute a significant portion of the wildlife found here. Fifteen species of amphibians and 21 reptile species are currently known to inhabit the area. As discussed in the Sensitive Species section below, the northern leopard frog (*Rana pipiens*, a Montana/Dakotas BLM sensitive species) is currently common in the planning area. Other relatively common species include the painted turtle (*Chrysemys picta*), prairie rattlesnake (*Crotalus viridis*), and plains garter snake (*Thamnophis radix*) (Kiesow 2006).

Current management for reptiles and amphibians is limited to habitat protection through broad-scale management actions such as Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) and riparian and aquatic habitat management.

Habitat management challenges for reptiles and amphibians include maintaining populations; minimizing wetland habitat degradation, loss, and impacts from contaminants; controlling exotic and invasive species such as predatory fish and noxious weeds that degrade wetland habitats; minimizing the impacts of diseases; and maintaining natural hydrologic regimes. Amphibian larvae may be sensitive to contaminants, and adults may bioaccumulate toxic pollutants from insect prey. Some amphibian populations in the planning area have recently undergone or are currently undergoing declines.

Special Status Species

The BLM in South Dakota accomplishes its threatened and endangered species management through coordination with the USFWS and SDGFP. Whenever the BLM is considering a discretionary action that may affect a listed or proposed species or designated or proposed critical habitat, the BLM will engage the FWS early in the project development process and seek recommendations designed to minimize or avoid potential adverse effects to resources protected under the ESA.

Federally listed species can have critical habitat identified as crucial to species viability. For those species that are listed and have not had critical habitat designations identified for them, the BLM cooperates with the USFWS to determine and manage habitats of importance. Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act of 1918 and Bald Eagle Protection Act of 1940. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act of 1934 (16 USC 661-667e).

Indicators for special status species reflect population levels and viability, distribution, habitat stability, and quantity and quality of preferred and suitable habitat. These criteria include critical breeding, wintering grounds, corridors needed to support migrations, and a healthy genetic pool needed for the species to adapt to future circumstances and conditions. Indicators are detected through allotment evaluations, stream and vegetation monitoring, SDGFP population surveys, the South Dakota Natural Heritage Program (SDNHP) database, field observations, and USFWS data. Inventory data is lacking for several of these nongame species in the planning area, and future studies will be required to determine more exact population numbers and trends.

For most of the special status wildlife species, habitat loss and fragmentation have been and remain a primary cause of their imperiled status. Some of these species have also suffered from historic efforts to extirpate them, and some suffer competition or predation from species that have expanded their range or that have been introduced into the area.

A number of bird, fish, mammal, insect, amphibian, reptile, and plant species are considered special status species for BLM within the planning area. BLM special status species include state listed, federally listed, proposed to be listed, sensitive, and candidate species. The State of South Dakota's sensitive species are given the designation of state listed or species of management concern. This designation applies to the State of South Dakota only.

Montana/Dakotas BLM sensitive species are those species designated by the BLM State Director, usually in cooperation with the state agency responsible for managing the species. The Special Status Species list will be reviewed and updated by the State Office a minimum of every 5 years.

Species designated as Bureau sensitive must be native species found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either:

1. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or

2. The species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.

For most BLM Montana/Dakotas special status species, comprehensive data on population numbers and distribution within the planning area are not available. The SDNHP uses occurrence data to identify the presence and location for some special

status wildlife species in the planning area; however, these data reflect observations from opportunistic or project-specific surveys, rather than a complete inventory of the planning area.

The BLM Montana/Dakotas special status species in the planning area are primarily associated with grasslands and sagebrush habitats. Many of the sensitive species are relatively common in South Dakota because their habitat is more abundant than in other parts of their range.

Most BLM management actions will be directed at maintaining habitat and the processes that provide habitat diversity in the planning area. Where species specific management can improve individual special status species habitats or populations, those actions will be considered as long as they are also compatible with the long-term existence of other habitats and species.

If species which occur on BLM lands in the planning area are added to the threatened and endangered list in the future, management actions will be developed to conserve, enhance, and protect the species in accordance with the Endangered Species Act and according to applicable BLM guidance.

Following is a discussion of individual species in the planning area which are federally listed as threatened, endangered or candidate species, or are listed as Montana/Dakotas BLM sensitive species.

Wildlife Management

The BLM is responsible for managing wildlife habitat on BLM lands. (http://www.blm.gov/mt/st/en.html)

Managing wildlife species populations is the responsibility of state and other federal wildlife management agencies. The SDGFP manages resident wildlife populations and migratory game birds across the state which encompasses the planning area. (http://gfp.sd.gov/)

The USFWS provides regulatory oversight for all species that are listed, proposed for listing, or are candidates for listing under the ESA. The USFWS also administers the Migratory Bird Treaty Act, which protects migratory bird species, whether hunted (waterfowl) or not (songbirds.) (http://www.fws.gov/endangered/)

Threatened, Endangered, or Candidate Species

Under the provisions of the Endangered Species Act (ESA) of 1973, the Secretary of the Interior has designated species as threatened, endangered or candidate species (see Table 3-15 below for those designated species that may occur within the planning area). Candidate species are those species that have been officially proposed for listing as threatened or endangered. The list of special status (federally threatened, endangered, or candidate species) in the planning area was reviewed and updated by the South Dakota Field Office, Ecological Services of USFWS on February 11, 2013.

Table 3-15
Federally Listed Threatened, Endangered, or Candidate Species that May Occur within the Planning Area

Common Name	*Scientific Name*	*Federal Status*	*State Status*
Birds			
Interior Least Tern	*Sterna antillarum athalassos*	Endangered	Endangered
Piping Plover	*Charadrius melodus*	Threatened	Threatened
Whooping Crane	*Grus americana*	Endangered	Endangered
Greater Sage-Grouse	*Centrocercus urophasianus*	Candidate	Not listed
Sprague's Pipit	*Anthus spragueii*	Candidate	Not listed
Rufa Red Knot	*Calidris canutus rufa*	Threatened	Not listed
Mammals			
Black-footed ferret	*Mustela nigripes*	Endangered	Endangered
Gray wolf	*Canis lupus*	Endangered west of Mississippi River only	Not listed
Northern long-eared bat	*Myotis septentrionalis*	Threatened	Not listed

Table 3-15 Federally Listed Threatened, Endangered, or Candidate Species that May Occur within the Planning Area			
Common Name	***Scientific Name***	***Federal Status***	***State Status***
Fish			
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Endangered
Topeka shiner	*Notropis topeka*	Endangered	Not listed
Insects			
American burying beetle	*Nicrophorus americanus*	Endangered	Not listed
Dakota skipper	*Hesperia dacotae*	Proposed Threatened	Not listed
Poweshiek skipperling	*Oarisma poweshiek*	Proposed Endangered	Not listed
Plants			
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	Not listed
Mussels & Shellfish			
Scaleshell mussel	*Leptodea leptodon*	Endangered	Not listed
Higgins eye (pearlymussel)	*Lampsilis higginsii*	Endangered	Not listed

Source: (USDI, USFWS, February 11, 2013)

Threatened and Endangered Species – Mammals

Presently two species of mammals are listed as federally endangered, and one mammal is proposed endangered. The black-footed ferret is endangered across its range, except where populations have been established as experimental. South Dakota has both endangered and experimental populations of black-footed ferrets, none of which are known to exist on BLM-administered lands. The gray wolf has been de-listed east of the Missouri River; however, west of the Missouri River in South Dakota gray wolves are still listed endangered. There are no known populations of gray wolves in South Dakota, but transient individuals are known to occur in the state. The northern long-eared bat is proposed endangered (October 2013) and occurs in forested regions of the state. In western South Dakota, northern long-eared bats are known in the Black Hills and as far east in the prairie as Wall. If federally listed mammals become established on BLM lands, those species will be managed by the BLM in the same manner as other listed or endangered species.

The **black-footed ferret** (*Mustela nigripes*), considered the rarest mammal in North America, became listed as endangered on March 11, 1967. The historic range of the black-footed ferret in South Dakota corresponds to the range of the black-tailed prairie dog. The presence of black-footed ferrets is highly dependent on the size and extent of areas occupied by prairie dogs and reintroduction of ferrets would occur in black-tailed prairie dog habitat.

Historical records show that the black-footed ferrets were found in the planning area into the 1970s. They were thought to be extinct in North America by 1980, but were then discovered in Meeteetse, Wyoming, in September 1981. A successful black-footed ferret captive breeding program was developed from this population and has provided animals for reintroductions throughout their former range. Currently, there are six black-tailed prairie dog complexes in South Dakota where ferrets have been reintroduced as part of this program: Badlands National Park, 1994; Conata Basin, 1996; Cheyenne River Indian Reservation, 2000; Rosebud Indian Reservation, 2002; Lower Brule Indian Reservation, 2006; and Wind Cave National Park, 2007. Only 2,862 acres of black-tailed prairie dogs towns are on BLM-administered surface lands (6,631 acres on all BLM-administered minerals) in the planning area. Most of the black-tailed prairie dog towns have additional acreages that are on adjoining private lands.

The **gray wolf** (*Canis lupus*) originally was listed as endangered in 1967. The historic range of gray wolves included all of South Dakota. Currently, there are breeding populations of wolves in the adjoining states of Wyoming, Montana, and Minnesota, and some individuals move from these populations into and through South Dakota. The population in Wyoming is from reintroduction. Montana has populations in the northwest portion of the state from natural reproduction and dispersal and in the southwest portion from reintroduction. The potential for wolves re-establishing in South Dakota is

low; with the high potential for interface with humans and human-related activities (agriculture and recreation), the probability of negative encounters would inhibit their re-establishment.

The **northern long-eared bat** (*Myotis septentrionalis*) was listed as threatened by the FWS in 2015. White-nose syndrome is implicated as the greatest threat to this species, resulting in drastic declines of northern long-eared bats in the eastern part of its range. Northern long-eared bats are found in the Black Hills of South Dakota, where they use trees, caves, mines, and human-built structures as roosts and hibernacula.

Threatened and Endangered Species – Birds

Four bird species occurring in the planning area are listed as federally endangered or threatened. The interior least tern (*Sterna antillarum athalassos*) and the whooping crane (*Grus americana*) are listed as endangered, and the piping plover and rufa red knot are listed as threatened.

The BLM has no firm evidence that these species currently occupy BLM-administered lands, but given the current distribution it is possible they may be present. If these species are discovered or become established on BLM-administered lands, or if other species become listed, those species will be managed the same as listed as other endangered species. These three bird species all have USFWS recovery plans in place.

The **interior least tern** was listed as endangered in May 1985. This tern occurs on a very limited or sporadic basis, and the potential for breeding on BLM lands in the planning area is low but may be affected by BLM management of federal minerals. Breeding is known to occur in and along the Cheyenne and Missouri rivers. They nest primarily on barren to sparsely vegetated riverine sandbars, dike field sandbar islands, sand and gravel pits, and lake and reservoir shorelines from late April to August. Threats to the species' survival include the actual and functional loss of riverine sandbar habitat. Recovery actions to protect and restore least tern populations are outlined in the 1990 Recovery Plan and the 2005 South Dakota Interior Least Tern Management Plan (SDGFP 2005). Current management for interior least terns is focused on minimizing disturbances to breeding birds from surface-disturbing activities tied to mineral leasing through timing and spatial restrictions. No critical habitat has been identified in South Dakota, but the breeding range for least terns in South Dakota is all along the Missouri River and a short way up the Cheyenne River.

The **whooping crane** was listed as endangered in 1970. No known whooping crane stopovers, roosting, or nesting habitat occurs on BLM-administered lands or minerals within the planning area, but the area is within the whooping crane's principal migration corridor and the northeast corner of the state is probably historic breeding area. Also, sighting and recovery of banded birds has occurred across central and western South Dakota during the migration when they use fields and shallow wetlands (Tallman et al. 2002).

The **piping plover** was listed as federally threatened in 1986. Piping plovers breed on barren sand and gravel beaches in the planning area, and low water levels expose appropriate shoreline breeding and nesting habitats. Nesting success is often dependent on subsequent water level fluctuations, and flooding is often a major source of nest mortality. Piping plovers are known to occur on the exposed gravel or sand shorelines or islands of the Missouri River and its western tributaries. Recovery actions to protect and restore piping plover populations are outlined in the 1986 Recovery Plan and the 2005 South Dakota Piping Plover Management Plan (SDGFP 2005). Current management for piping plovers is focused on minimizing disturbances to breeding birds from surface-disturbing activities tied to mineral leasing through timing and spatial restrictions. In 2002 the USFWS designated critical habitat for the piping plover (USFWS 2002) in South Dakota. Lake Oahe is designated as critical habitat, as is the Missouri River from Fort Randall Dam south to Ponca State Park, Nebraska, including Lewis and Clark Lake.

The **rufa red knot** was federally listed as threatened in January 2015. This bird is a long-distance migrant that breeds in the Arctic and winters in the southern reaches of South America. Rufa red knots are vulnerable to pollution or deterioration

Experimental Population

An ESA experimental population is a geographically described group of reintroduced plants or animals that is isolated from other existing populations of the species. Members of the experimental population are considered to be threatened under the ESA, and thus can have special regulations written for them. In addition, if the experimental population is determined to be "nonessential" to the survival of the species, for some activities the experimental population is treated like a species that is proposed for listing as threatened or endangered. In other words, the nonessential experimental population is not given the full protections of the ESA.

of staging sites where large aggregations of the birds occur during migration. Marked declines in the early 2000s are linked to human harvest of food sources along their migration route. The primary threat to rufa red knot is climate change due to changes in sea level and the ramifications of that to nesting and feeding habitats. Commercial harvest of horseshoe crabs and factors related to climate change have been linked to decline of rufa red knots (78 FR 60024). Migration fly-ways follow both the Atlantic coast and a swath through the Great Plains. While major stopovers in the Great Plains are known primarily in Canada, reports of migrating individual rufa red knots occur in South Dakota. . Rufa red knots use major staging areas along the east coast during migration, and rely on horseshoe crab eggs, small clams, and mussels for food. Some rufa red knots stage along the Gulf coast and migrate inland through the planning area.

Threatened and Endangered Species – Amphibians and Reptiles

No amphibian or reptile species in the planning area are currently listed as federally threatened, endangered, or candidate species.

Threatened and Endangered Species – Fish

Two fish species, pallid sturgeon (*Scaphirhynchus albus*) and Topeka shiner, are listed as federally endangered and are presently known to occur in the planning area. These species are not known to occupy BLM lands or to be affected where BLM manages the federal minerals.

The **pallid sturgeon** was listed by the USFWS as a federally endangered species in 1990. 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 historic and current distribution of the pallid sturgeon in South Dakota includes the entire Missouri River (almost entirely restricted to the main channel). Since 1980, the most frequent occurrence in South Dakota has been the headwaters of Lake Sharpe, southeast of Pierre. This species is a bottom dweller and is found in areas of strong current and firm sand bottom in the main channel of large turbid rivers. It is almost entirely restricted to the Missouri River's main channel (Guide to Common Fishes of South Dakota 1994). No critical habitat rules have been established for the pallid sturgeon.

The **Topeka shiner** was listed as federally endangered by the USFWS in January 1999 (USFWS 2001). Historically, the Topeka shiner was widespread throughout the central prairie region of the Missouri, Mississippi, and Arkansas River drainages. The species range included eastern South Dakota, southwestern Minnesota, Iowa, Nebraska, Kansas, and Missouri (Bailey and Allum 1962; Gilbert 1980). Before listing, limited survey data suggested the shiner only occupied ten percent of its historic range (USDI, USFWS 2011).

Recent studies in South Dakota have documented the Topeka shiner in 80 percent of historically known streams, along with many streams where Topeka shiners were not previously reported. These recent findings suggest Topeka shiners are more abundant in South Dakota than other states within its range. The Topeka shiner occupies tributaries of the James, Vermillion, and Big Sioux rivers in eastern South Dakota. No BLM-administered public land is located along or near these rivers. The USFWS exempted the State of South Dakota from the list of states receiving critical habitat designation for the Topeka shiner because of a state management plan. Topeka shiners prefer small, quiet prairie streams with cool temperatures and good water quality; they occupy a variety of habitats such as runs, pools, and backwater areas (Topeka Shiner Management Plan 2003).

Threatened and Endangered Species – Insects

One insect species listed as federally endangered, the American burying beetle (*Nicrophorus americanus*), occurs in the planning area. They may be found within the planning area but are not known to occupy BLM lands. However, they may occupy lands where BLM manages federal minerals.

The **American burying beetle** (*Nicrophorus americanus*) was listed as federally endangered by the USFWS in 1989. This species utilizes rangeland and intact natural habitats and can be found mainly in well-drained soils with non-living organic material. Vegetation structure and soil type were not historically limiting to this species, but soils suitable for carcass burial are essential. In South Dakota, records indicate that historically the species may have ranged from

Brookings and Union counties in the east to Haakon County in the west. A large population of the endangered beetle was discovered in 1995, ranging from southwest Gregory County through southern Tripp County. The USFWS published the American Burying Beetle Recovery Plan in 1991 (USFWS 1991). No critical habitat rules have been established for the American burying beetle.

The **Dakota skipper** (*Hesperia dacotae)* was moved from Candidate species status to proposed Threatened in October 2013 (Federal Register, Vol. 78, No. 206). The Dakota skipper butterfly was listed as a federal candidate species in 2004. This species uses undisturbed tall and midgrass prairie of South Dakota. Today, it is mainly found in northeastern South Dakota but may occur farther west; some species are present on BLM lands in Brule and Stanley counties in the central part of the state. The USFWS is currently developing a Candidate Conservation Plan for the species.

The **Poweshiek skipperling** (*Oarisma Poweshiek)* was moved from Candidate species status to proposed Endangered in October 2013 (Federal Register, Vol. 78, No. 206). The Poweshiek skipperling was listed as a federal candidate species in 2005. This butterfly is found in remnant high-quality tallgrass prairie in northeastern and eastern South Dakota. Forage at the larval stage varies by region, but consists of various native sedges and grasses, while butterflies feed on the nectar of black-eyed Susans, prairie coneflowers, and other native tallgrass prairie wildflowers. Poweshiek skipperling is known to occur in Brookings, Clark, Codington, Day, Deuel, Grant, Hamlin, Marshall, and Roberts Counties in South Dakota.

Threatened and Endangered Species – Plants

The **Western prairie fringed orchid** (*Platanthera praeclara*), listed as federally threatened by the USFWS in 1989, was historically found in the planning area, in the moist tallgrass prairies and sedge meadows of eastern South Dakota. (http://www.fws.gov/southdakotafieldoffice/ORCHID.HTM accessed September 2011). At this time they appear to be extirpated from South Dakota.

Threatened and Endangered Species – Mussels and Shellfish

The **Scaleshell mussel** (*Leptodea leptodon*) was listed as federally endangered by the USFWS in 2001 and is found only in scattered populations that include areas in Clay, Union, and Yankton counties in South Dakota. Scaleshell mussels inhabit large, stable rivers and streambeds. They are sensitive to pollution, sedimentation, exotic species (zebra mussels; *Dreissena polymorpha*), and dams or obstructions that prevent the fish that host their larval stage from moving upstream. The USFWS has a recovery plan in place for scaleshell mussels.

The **Higgins eye** (**pearlymussel**; *Lampsislis higginsii*) was listed as federally endangered by the USFWS in 1976. A recovery plan was created and was revised in 2004 to reflect the threat of zebra mussels to Higgins eye mussels. Higgins eye mussels are found in deep free-flowing rivers, and are threatened by water impoundment, sedimentation, pollution, and invasive zebra mussels. In South Dakota, the Higgins eye mussel is found only in Yankton County.

Proposed and Candidate Species

The **Sprague's pipit** (*Anthus spragueii)* became a candidate species when it was warranted but precluded from listing under the Endangered Species Act in September 2010. This pipit is known to occur in Harding, Perkins and Stanley counties. Sprague's pipit use grasslands of intermediate height and sparse to intermediate vegetation densities with other habitat features of low visual obstruction, moderate litter cover and little or no woody vegetation (Dechant 2004). The current status of this species on BLM-administered surface or minerals is unknown.

Greater Sage-Grouse

The following discussion addresses management of sage-grouse and sagebrush habitat in South Dakota only. Larger scale conditions and trends are discussed in the Management Zone 1 discussion in the next section. This planning effort focuses on Greater Sage-Grouse only. There are no other subspecies of sage-grouse in South Dakota. As noted in Chapter 1, the use of 'sage-grouse' in this document refers to Greater Sage-Grouse only.
Several petitions have been submitted to list Greater Sage-Grouse as threatened; the first petitions were submitted to the USFWS in 2002. In January 2005, the USFWS determined that listing under the ESA was not warranted, but a subsequent

court decision remanded that determination to USFWS for reconsideration. On March 5, 2010, the USFWS determined that the sage-grouse is warranted (for listing) but precluded by higher priority listing needs, making it a candidate species. Sage-grouse conservation is a priority for the BLM, and emphasis has been placed on planning efforts throughout their range in North America, including South Dakota.

Sage-grouse in South Dakota represents the easternmost point of the species distribution. Sage-grouse are found mainly in northwestern South Dakota in Butte and Harding counties. A small population has been documented in the southwestern part of South Dakota in southwestern Fall River County. Sage-grouse are primarily associated with big sagebrush communities in grassland-shrub and shrub vegetation types. Sage-grouse prefer sagebrush for nesting cover throughout their range, and sagebrush comprises nearly 100 percent of winter diet (Connelly et al. 2000). Nest success has been positively correlated with sagebrush density and grass height (Kaczor 2008, Swanson 2009). Leks (see Glossary) are key activity areas for populations and are most often located in open areas surrounded by sagebrush cover.

Sage-grouse habitat and core use areas in South Dakota are smaller and more closely defined than in other states, and habitat distribution and use is more concentrated. The habitat in South Dakota is naturally fragmented being on the eastern edge of both sage-grouse and sagebrush range. A greater grass component and less sagebrush density within sage-grouse habitat is found here compared to other areas across sage-grouse range (Kaczor 2008). Swanson (2009) and Kaczor (2008) studies indicate that sage-grouse have concentrated use areas. Adequate protection of sage-grouse relies on conservation of such identified areas of use.

Sage-grouse have been declining across their range at an estimated rate of two percent per year in the U.S; this trend has been reflected in the South Dakota population. Several threats to sage-grouse exist in the planning area.

Domestic livestock function as a keystone species through grazing and management actions related to grazing. These actions do not preclude wildlife and vegetation, but they do influence ecological pathways and species persistence (Bock et al. 1993). The effects of grazing on sagebrush habitats in the planning area are much different than effects noted in the Great Basin since the landscape in the planning area is adapted to withstand grazing disturbance (Knick et al. 2011). Historically, large numbers of bison (*Bison bison*) moved nomadically through the planning area 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 one to eight years (Malainey and Sherriff 1996). Bison were replaced with domestic livestock in the late 1800s. The intensity and duration of grazing in the planning areas 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 planning area, particularly when combined with a concurrent reduction in the amount of 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 due to 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 is the construction of fencing and water developments. Barbed wire fences contribute to direct mortality of sage-grouse through fence collisions (Stevens 2011, Stevens et al. 2012) and water developments may contribute to increased occurrence of West Nile Virus in sage-grouse (Walker and Naugle 2011). Ongoing rangeland health assessments on BLM surface estate indicate that about 93 percent of the areas assessed are meeting all rangeland health standards and seven percent are not meeting standards. Current livestock grazing practices are a significant factor on two percent of the rangelands that are not meeting standards across the planning area.
Infrastructure such as roads, fences, and powerlines have fragmented habitat and are a threat across the range of sage-grouse in the planning area. The potential for infrastructure associated with renewable energy development is also a major threat to sage-grouse and their habitat in the planning area. Development of oil and gas resources is a major threat mainly in the eastern portion of their range which includes the planning area, although there is less potential than in adjacent states. Indirect effects include changes to habitat quality, predator communities, or disease dynamics. This threat has the potential to negatively affect the population and their habitat (Naugle 2011).

The planning area has 337 existing oil and gas wells, of which 227 occur in the high potential for oil and gas, comprising 318,000 acres and a rate of .45 wells/square mile. Also, 82 wells are in the moderate potential areas comprising 476,000

acres and a rate of .11 wells/square mile. The high and moderate potential areas contain more than 91 percent of the total existing wells. Currently there are 43 active oil and gas wells in core sage-grouse habitat. Wildfire is not a primary threat to sage-grouse habitat in the planning area. In most cases, with the accessibility of the area, fires are kept to 100 acres or less, although if conditions are right a small chance exists for a large wildfire that could burn thousands of acres of habitat.

Climate change is a factor that could potentially play an important indirect role by exacerbating the threats of wildfire, drought and West Nile virus. Severe or prolonged drought has the potential to extirpate peripheral populations (Wisdom et al. 2005).

The conversion of rangeland to cropland has fragmented wildlife habitat across the planning area but to a lesser degree in sage-grouse core use areas in northwest South Dakota. While rangelands in other portions of the planning area have been converted to croplands at a rate of 1.1 percent over a ten year period (USDA ERS 2011), National Ag Statistics Query Reports indicate a decline in planted crop acres in the portions of Butte and Harding counties that are frequented by sage-grouse (core use areas) (NAS Query Reports). Major factors that influence the conversion of rangeland to croplands include changes in market incentive loans, changes in farm programs such as the Conservation Reserve Program (CRP) and changes in crop disaster insurance. Other major factors include market factors, interest rates, production costs and increased yield as a result of improved technology.

Conservation Reserve Program (CRP)

The Conservation Reserve Program (CRP) is a cost-share and rental payment program under the USDA, administered by the Farm Service Agency. Technical assistance for the CRP is provided by the USFS and the NRCS. The NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. The CRP program encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers.

(http://www.nrcs.usda.gov/programs/crp/)

Irrigation has not been a major factor in modification of vegetation in sage-grouse habitat in South Dakota. Although non-native plant species can be found mixed with native species, extensive monotypic stands of non-native grasses are limited in sage-grouse habitat in South Dakota. Urbanization and subdivision for housing development has not been a major threat to sage-grouse in the planning areas as Butte and Harding counties have very low densities of people per square mile (.05 to 4.5 persons per sq. mile) and contain few towns. The lack of quality drinking water within reasonable drilling limits has been a limiting factor for urban or rural development in and near sage-grouse core use areas. Most areas that have been developed for housing consist of a ranch house with a few outbuildings.

Invasive plants or contaminants are not a primary threat to the population within the planning area at this time. The past practice of spraying sagebrush with herbicide has reduced the acres of sagebrush and fragmented the habitat, but sagebrush spraying is not a current practice that has been used widely. The use of other pesticides (insecticides) is a potential threat if broadcast spraying is across large areas of habitat. At the present time, large-scale broadcast weed spraying treatments in sage-grouse habitat is considered unlikely as noxious weeds are limited in sage-grouse habitat in South Dakota. Drainages are the most likely areas to be treated and the majority of treatments currently consist of spot treatments in selected areas.

Recreational activities in the planning area involving the sage-grouse include a small amount of bird watching and hunting. The sage-grouse population in the planning area has not been overhunted. The hunting season on sage-grouse was closed in 2013 and 2014 while the average harvest between 2008 and 2012 was 11.2 birds/year (SDGFP 2014b).

The sage-grouse population in South Dakota had confirmed West Nile virus outbreaks in 2006 and 2007 (Kaczor 2008). The population in the planning area is the easternmost population and is non-migratory (Swanson 2009). Sage-grouse have fidelity to seasonal habitats (lekking, nesting, brood-rearing and winter). The population in the planning area is more vulnerable because the birds are on the periphery of their range and habitat is more fragmented than core areas in other states; therefore, they are more sensitive to additional man-made fragmentation of habitat.

Predators and sage-grouse

Predation is one of five specific ESA listing criteria; however the USFWS did not identify predation as a significant threat to sage-grouse populations in their 2010 decision to list the species as warranted for protection under the Endangered Species Act. The USFWS acknowledged that increasing patterns of landscape fragmentation are likely contributing to increased predation on the species and identified two areas, neither in South Dakota (but located in southwestern Wyoming and northeastern Nevada), where predators may be limiting sage-grouse populations because of intense habitat alteration and fragmentation. Despite the USFWS document stating that predation is not a significant threat to sage-grouse populations in South Dakota, the public remains concerned about the influence of predators on sage-grouse conservation.

Predators are part of the ecosystem and they have always preyed upon sage-grouse. Predators that prey on sage-grouse tend to be generalists that take prey opportunistically but do not focus solely or preferentially on sage-grouse (Hagen 2011). Predators of juvenile and adult sage-grouse are commonly coyote, red fox, American badger, bobcat, golden eagles, and several other species of raptors (Schroeder and Baydack 2001; Hagen 2011). Younger birds can also be taken by common ravens, northern harriers, ground squirrels, and weasels. Nest predators include coyote, American badger, common raven and black-billed magpie (Schroeder and Baydack 2001; Hagen 2011). Smaller predators of sage-grouse, such as red fox or skunks, can also serve as prey to larger predators such as coyotes.

Historically, predator control programs in North America were designed to protect domestic livestock, not wildlife (Hagen 2011). Predator control as a tool to manage grouse populations was rarely recommended historically, even for threatened and endangered populations in altered or fragmented habitats (Patterson 1952, Schroeder and Baydack 2001). It is likely the termination of widespread predator control in the early 1970s has influenced changes in predator abundance observed anecdotally by the public in recent years (Montana Sage Grouse Working Group 2005). Maintaining and enhancing intact ecosystems of sufficient size and quality to support a particular species is of greater ecological value and sustainability than an alternate approach that relies heavily on human intervention (e.g., artificial feeding, predator control, animal husbandry, zoos). The former approach works with the natural system that is adapted to working as an interconnected resilient network. The latter approach is costly, temporary, risks variable results, and is not likely to avert an ESA listing (United States Department of Interior 2010).

Human altered landscapes have contributed to significant increases over historical numbers in some predator abundances, particularly red fox and ravens (Coates and Delehanty 2010, Sauer et al. 2012). The influx of predators in altered sagebrush habitat can lead to decreased annual recruitment of sage-grouse (Schroeder and Baydack 2001, Coates 2007, Hagen 2011). Sage-grouse in altered systems are also typically forced to nest in less suitable or marginal habitats where predators can more easily detect nesting birds (Connelly et al. 2004). In Strawberry Valley, Utah, low sage-grouse survival was attributed to an unusually high density of red fox that were attracted to the area by anthropogenic activity (Baxter et al. 2007). Holloran (2005) attributed increased nest depredation rates on sage-grouse to high corvid abundance in western Wyoming; the latter was influenced by anthropogenic structures associated with natural gas development. In the same area, Bui (2009) found ravens used road networks, fences, power lines, and other infrastructure associated with development. Bui et al. (2010) also detected a negative association between raven presence and sage-grouse nest and brood fate. Coates and Delehanty (2010) found increased raven density in northeastern Nevada was associated with decreased sage-grouse nest success, especially in areas with lower shrub density. Habitat fragmentation, infrastructure, weather, urban development, and improper grazing can increase predation pressure on sage-grouse. Sage-grouse populations demonstrate annual and cyclic fluctuations, which are influenced by weather patterns such as drought and the composition and abundance of predators (Montana Sage Grouse Working Group 2005). Montana populations appear to cycle over approximately a 10-year period under existing habitat conditions and the current combination of weather and predation (Montana Sage Grouse Working Group 2005; Montana Fish, Wildlife and Parks, unpubl. data). Longer term trends in sage-grouse population abundance and distribution can be a function of habitat loss or deterioration (Garton et al. 2011). The majority of Montana's sage-grouse populations are expected to persist over the next 100 years, if habitat conditions remain consistent, which suggests Montana's populations are relatively stable (Garton et al. 2011). While the Dakotas population is expected to persist as well, it is well known that smaller populations and those at the edge of the species' distribution are at greater risk of decline. Sage-grouse are part of the sagebrush grassland ecosystem that comprises an interlinked web of plant and animal species, including herbivores and carnivores. As one of many prey species in sagebrush habitats, sage-grouse are adapted to predation and in unaltered systems will persist indefinitely with predation pressure (Hagen 2011). The influence of predation on sage-grouse population dynamics only becomes a problem when vital rates, especially nest, chick, and hen survival, are consistently reduced below naturally occurring levels (Taylor et al. 2012). Naturally-occurring variability in

vital rates is a function of annual variation in conditions (e.g., weather, vegetation cover quality, predator abundance) and is expected with a species that shows cyclic tendencies. Based on a number of research projects, reported vital rates for sage-grouse populations in Montana vary within range-wide estimates, suggesting predation rates are within the range of normal variability. Good quality and quantity of habitat reduces predation pressure and quality habitat is essential for sage-grouse population stability. Predator management can provide beneficial short-term relief to localized sage-grouse populations where predation has been identified as a limiting factor for population stability. Predator control is managed cooperatively by Animal and Plant Health Inspection Service (U.S. Department of Agriculture) Wildlife Service, FWP, and the USFWS. Federal laws, such as the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act, limit options for managing avian predators.

Recent predator control programs designed to benefit sage-grouse have had mixed results (United States Department of Interior 2010, Hagen 2011). In Strawberry Valley, Utah, fox removal appeared to increase adult survival and productivity but inference is limited because a control area was not included to compare changes in demographic rates, which were coincidentally increasing across the region during the study period (Baxter et al. 2007). Coyote control, however, appeared to have no effect on nest success or chick survival in Wyoming (Slater 2003). In fact, removal of coyotes can lead to a release of otherwise suppressed medium-sized predators, such as red fox, which tend to be more effective predators of sage-grouse nests and individuals (Mezquida et al. 2006). Ongoing control efforts of mammalian and avian predators (except raptors) in southwestern Colorado designed to increase recruitment in a small population of Gunnison's sage-grouse may be showing some success but sample sizes are extremely low (5 chicks monitored/year; Colorado Parks and Wildlife, pers. comm.). There are 13 displaying males currently in this population and cost of monitoring and control has totaled $267,000 over 5 years (Colorado Parks and Wildlife, pers. comm.), bringing in to question the sustainability of this program. Raven removal in northeastern Nevada resulted in short-term reductions in raven populations; however, other individuals re-populated the vacated habitat within a year (Coates 2007). Badger predation may also have compensated somewhat for decreases in raven numbers (Coates 2007). Predation by ravens on sage-grouse in southwestern Wyoming was attributed primarily to territorial pairs, not groups of juveniles, sub-adults, and non-breeding birds (Bui et al. 2010). Thus, the removal of raven groups at foraging sites is unlikely to influence sage-grouse nest success, and the removal of territorial pairs will likely have only short-term effects until the habitat is re-occupied by a new pair.

The state of South Dakota has few regulatory mechanisms in place to protect sage-grouse at the local level. At the state level sage-grouse are a species of concern, but that does not give any additional regulatory authority specific to sage-grouse. The 2010 decision of warranted but precluded for sage-grouse states that the BLM's current application of regulatory authority falls short of meeting the conservation needs of the species range-wide (Federal Register Proposed Rules March 4, 2010).

As stated above, the South Dakota population is considered non-migratory, but recent research has shown there is interaction with the populations in Wyoming, Montana, and North Dakota. Sixty sage-grouse leks are identified on the SDGFP spring lek count data tables. Only forty-three of the identified leks have had birds observed on them in the last thirty years. A 2011 survey in the planning area showed 21 active leks, of which two were on BLM-administered surface, eight on split-estate, nine on private land, and two on state land. Almost all the nesting and brood-rearing habitats surrounding these leks have BLM surface and/or mineral estate within them. The BLM and SDGFP have surveyed and monitored sage-grouse leks annually since the 1960s.

In 2014, the SDGFP developed a new South Dakota Greater Sage-Grouse Management Plan to guide the management of sage-grouse in South Dakota (SDGFP 2014b). SDGFP increased survey efforts during the development of the 2008 version of the South Dakota Greater Sage-Grouse Management Plan to locate additional leks to provide an index of relative change in population abundance. .In 2014, the average number of males per lek counted on all SDGFP priority active leks across Butte and Harding counties was 4.6 males/lek. The estimated breeding population (using two females for every male counted; Dahlgren 2010) is approximately300 birds.

The BLM has co-sponsored research projects related to sage-grouse in Butte and Harding counties in northwestern South Dakota and Bowman County in southwestern North Dakota. However, specific wintering concentration areas of sage-grouse within the planning area have not been well documented to date. Impacts to sage-grouse include sagebrush habitat fragmentation; disturbances related to energy (oil and gas, and wind) exploration, development and production; pathogens (West Nile virus); and overhead power lines. Current management of sage-grouse focuses primarily on protection of sage-grouse leks and habitats surrounding leks through seasonal and spatial stipulations for surface-disturbing activities.

Management opportunities include protecting large blocks of existing habitat from further loss and fragmentation, reducing the disturbance from surface-disturbing activities, and controlling invasive and exotic plants.

Management of Greater Sage-Grouse within Management Zone 1 (MZ1)

The following discussion addresses sage-grouse management across MZ1. Management Zone 1 was developed as a management area by the National Sage-Grouse Conservation Planning Team based on similar management issues and sage-grouse habitat, and includes areas with similar climate, vegetation, fire regimes, and soils. Management Zone 1 includes central and eastern Montana, northeast Wyoming, southwest North Dakota and western South Dakota. This discussion in this section is not specific to South Dakota.

Sage-grouse habitats in MZ1 were historically a function of the interaction of physical factors (e.g., climate, soils, geology, elevation), and natural disturbance factors (e.g., fire, grazing, 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 sage-grouse occupation. The sagebrush species associated with sage-grouse habitat in MZ1 is primarily Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*). Other shrubs present 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*), and overall shrub cover is less than 10 percent (Montana Field Guide 2011). Perennial herbaceous components typically contribute greater than 25 percent vegetative cover and consist mostly of rhizomatous and bunch-form grasses, with a diversity of perennial forbs (Montana Field Guide 2011). The dominant grass in this system is western wheatgrass (*Pascopyrum smithii*) and sites may include other species such as Indian ricegrass (*Achnatherum hymenoides*), blue grama (*Bouteloua gracilis*), Sandberg's bluegrass *(Poa secunda*), or bluebunch wheatgrass (*Pseudoroegneria spicata*) (Montana Field Guide 2011). 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 in Montana and Wyoming (Montana Field Guide 2011). 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) (Montana Field Guide 2011). Big sagebrush is easily killed by fire at all intensities, and when exposed to fire, plants do not resprout (Wright, et al. 1979, Baker 2011). In southwestern Montana, Wambolt and others (2002) found that fire in big sagebrush is stand replacing, killing or removing most of the aboveground vegetation, and that recovery to pre-burn cover (of sagebrush) takes at least 20 years and up to 80 years (Baker 2011). In Montana, Wyoming big sagebrush may require a century or longer to recover from fire (Lesica et al. 2005). 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 (Montana Field Guide 2011).

Land ownership throughout MZ1 is predominantly private (70 percent). However, ownership of the remaining range of the sage-grouse in MZ1 is 61 percent private and 13 percent state or other federal ownership, with 26 percent on BLM-managed lands.

Sage-grouse populations have declined in portions of MZ1 through wholesale loss of habitat as well as through impacts to birds on the remaining habitat through disturbance and direct mortality. The most pervasive and extensive change to the sagebrush ecosystems in MZ1 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 sq. mi. (800,000 km^2) 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 MZ1.

Currently, native vegetation 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 the MZ and 91 percent of the MZ is within 6.9 km of cropland (Knick et al. 2011). Recent interest in biofuel production and high prices for small grains has resulted in an increase in the conversion of native grasslands or lands formerly enrolled in CRP to cropland, further emphasizing the importance of BLM lands and associated private lands managed for grazing to maintain 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 and/or 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 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; 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 also fragment remaining habitat for sagebrush-dependent species such as sage-grouse. Roads and OHV use can promote the spread of noxious weeds through vehicular traffic, and noxious weed infestations can further exacerbate the fragmentation effects of roadways. Irrigation water has also supported the conversion of native plant communities to hayfields, pastures and cropland, thereby fragmenting sagebrush habitats. Excessive grazing can result in the demise of the most common perennial grasses in this system and lead to an abundance of cheatgrass or Japanese brome (Montana Field Guide 2011).

The remaining sagebrush habitats in MZ1 are mostly managed as grazing lands for domestic livestock. Grazing has been an important part of historic disturbance regimes, and domestic livestock now fill the role once played by bison. Although grazing is a land use that is compatible with managing sage-grouse and their habitats, some of the developments made to facilitate livestock can be detrimental to sage-grouse and/or their habitats. Water developments and fences are two of the most pervasive developments in sage-grouse habitats across the MZ (Knick et al. 2011). Barbed wire fences contribute to sage-grouse mortality through collisions by sage-grouse with fences, especially when fences are located in areas near leks (Stevens 2011, Stevens et al. 2012)Water developments are particularly prevalent in the north central portion of the MZ. Additional habitat modifications associated with grazing management include mechanical and chemical treatments to increase grass production, often by removing sagebrush (Knick et al. 2011).

Other major land uses in the MZ include energy development (primarily oil and gas development), and urbanization and infrastructure. Oil and gas development in the MZ has occurred throughout the MZ but is concentrated in the southern portions (Powder River Basin), the north (Bowdoin Field), and the south and east (Williston Basin). Oil and gas development includes direct loss of habitat from well pad and road construction as well as indirect disturbance effects from increased noise and vehicle traffic. Oil and gas developments directly impact sage-grouse through avoidance of infrastructure, or when development affects survival or reproductive success. Indirect effects include changes to habitat quality, predator communities, or disease dynamics (Naugle et al. 2011). Currently, nearly 16 percent of the MZ is within 3km of oil and gas wells, a distance where ecological effect is 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.

Urbanization and infrastructure development in MZ1 has also impacted 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 MZ. Current estimates suggest about 16 percent of the MZ is within 6.9km of urban development, although MZ1 generally has lower population densities and lower rates of population increases compared to the other management zones (Knick et al 2011). Infrastructure development effects to sage-grouse habitats in MZ1 are primarily related to highways, roads, powerlines and communication towers, with nearly 92 percent of the MZ within 6.9km of a road, 32 percent within 6.9km of a powerline, and 4 percent within 6.9km of a communication tower (Knick et al. 2011). Increased recreation and OHV use on lands in the MZ are also thought to impact sage-grouse habitats, but have not been studied (Knick, et. al. 2011).

The cumulative and interactive impact of multiple disturbances and habitat loss has influenced the current distribution of sage-grouse in MZ1. The cumulative extent of human-caused changes, the human footprint, on sage-grouse habitat in MZ1 is highest at the northern edge of the MZ but occurs throughout the MZ (Leu and Hanser 2011). Population centers for sage-grouse in MZ1 (Doherty et al. 2011) generally correspond to areas lacking a high human footprint, and some of

these areas have been designated as core areas by Montana Fish, Wildlife and Parks (MFWP 2011). Sage-grouse range in MZ1 is overall very similar to portions of the range where sage-grouse have been extirpated, i.e., areas with high human footprints, mostly because of the abundance and distribution of sagebrush in the MZ (Wisdom et al. 2011), suggesting that sage-grouse in MZ1 are more vulnerable to declines than other portions of the sage-grouse range.

BLM Sensitive Species

The BLM Montana/Dakotas State Director designates sensitive species within the BLM Montana State Office jurisdiction, which include species for which there is a concern for population viability, the SDGFP list of South Dakota-listed species where they overlap with BLM-administered land, species that could become candidates for listing, species that are federal candidates for listing, and locally rare species. The Special Status Species List will be updated a minimum of every 5 years. The current list includes 8 mammal, 36 bird, 9 fish, 2 amphibians, and 4 reptile species (Table 3-16).

Sensitive Species – Mammals

Eight mammal species in the planning area are considered sensitive by BLM; five are bat species and three are terrestrial mammals. Limited knowledge exists about bat distribution and habitat needs in the planning area. The fringed-tailed myotis (*Myotis thysanodes pahasapensis*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis vollans*), northern long-eared bat (*Myotis septentrionalis*), and Townsend's big-eared bat (*Corynorhinus townsendii*) have all been identified during inventories in the Exemption Area in the northern Black Hills. All these bat species use abandoned mine shafts and caves to roost or hibernate. The status of actual populations for these species within the planning area is unknown.

White-Nose Syndrome (WNS)

WNS was first documented at four sites in eastern New York in the winter of 2006-07. WNS is an emerging disease in North America, which is named for the white fungus evident on the muzzles and wings of affected bats and has caused substantial declines in hibernating bats. A recently identified cold-loving fungus (*Pseudogymnoascus destructans*) causes skin lesions that are characteristic of this disease. The fungus could be responsible for the bat deaths, or it could be secondary to the cause. Nine bat species in 16 states have now been documented with either WNS or the fungus. For reasons that are still unclear, the disease causes bats to wake up during hibernation, using their stored fat reserves. Because they awake in the winter, they cannot find their number one food source, mosquitoes, and they freeze or starve. Mortality rates are approaching 100 percent at some infected sites.

While no specific management actions exist for bats, management actions associated with Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) are thought to maintain or improve habitats for most bat species. Water tanks located on BLM lands have been fitted with escape ramps to minimize drowning by bats and other species. Mine openings and caves will be fitted with bat gates or other devices to protect bat roosting habitat and hibernaculum where such action is determined to benefit bats. Closing cave and mine entrances may reduce the risk of white-nose syndrome spreading into these places and may increase safety for recreationists. Any future management actions specifically for bats will require more information on bat distribution and habitat use in the planning area. White-nose syndrome is a key concern and is likely to adversely impact bats in the planning area. The South Dakota Bat Management Plan was developed in 2003 by the bat working group.

Table 3-16
Special Status Species that May Occur within the Planning Area

Common Name	*Scientific Name*	*Federal Status*	*State Status**	*General Habitat*
Mammals				
Black-tailed prairie dog	*Cynomys ludovicianus*	BLM Sensitive		Grassland
Fringe-tailed myotis	*Myotis thysanodes pahasapensis*	BLM Sensitive		Shrubland/forest
Swift fox	*Vulpes velox*	BLM Sensitive	ST	Grassland
Long-eared myotis	*Myotis evotis*	BLM Sensitive		Forest
Long-legged myotis	*Myotis volans*	BLM Sensitive		Forest
Northern long-eared bat	*Myotis septentrionalis*	BLM Sensitive and FWS		Forest

Table 3-16
Special Status Species that May Occur within the Planning Area

Common Name	*Scientific Name*	*Federal Status*	*State Status**	*General Habitat*
		Threatened		
Northern river otter	*Lontra canadensis*		ST	River
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM Sensitive		Shrubland/forest
Birds				
American Dipper	*Cinclus mexicanus*		ST	Stream
Baird's Sparrow	*Ammodramus bairdii*	BLM Sensitive		Grassland
Bald Eagle	*Haliaeetus leucocephalus*	BLM Sensitive	ST	Forest/prairie
Black Tern	*Chlidonias niger*	BLM Sensitive		Wetland
Black-Backed Woodpecker	*Picoides arcticus*	BLM Sensitive		Forest
Blue-Gray Gnatcatcher	*Polioptila caerulea*	BLM Sensitive		Shrubland
Brewer's Sparrow	*Spizella breweri*	BLM Sensitive		Shrubland
Burrowing Owl	*Athene cunicularia*	BLM Sensitive		Grassland
Chestnut-Collared Longspur	*Calcarius ornatus*	BLM Sensitive		Grassland
Common Loon	*Gavia immer*	BLM Sensitive		Lake
Dickcissel	*Spiza americana*	BLM Sensitive		Grassland
Veery	*Catharus fuscescens*	BLM Sensitive		Forest
Nelson's Sharp-Tailed Sparrow	*Ammodramus nelson*	BLM Sensitive		Grassland/wetland
Ferruginous Hawk	*Buteo regalis*	BLM Sensitive		Grassland
Franklin's Gull	*Leucophaeus pipixcan*	BLM Sensitive		Grassland/wetland
Golden Eagle	*Aquila chrysaetos*	BLM Sensitive		Shrubland/grassland
Greater Sage-Grouse	*Centrocercus urophasianus*	BLM Sensitive and Candidate		Shrubland
Le Conte's Sparrow	*Ammodramus leconteii*	BLM Sensitive		Grassland/wetland
Loggerhead Shrike	*Lanius ludovicianus*	BLM Sensitive		Shrubland
Long-Billed Curlew	*Numenius americanus*	BLM Sensitive		Grassland
Marbled Godwit	*Limosa fedoa*	BLM Sensitive		Grassland/wetland
McCown's Longspur	*Calcarius mccownii*	BLM Sensitive		Grassland
Northern Goshawk	*Accipiter gentilis*	BLM Sensitive		Forest
Osprey	*Pandion haliaetus*		ST	Forest/lake
Peregrine Falcon	*Falco peregrinus*	BLM Sensitive	SE	Forest
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	BLM Sensitive		Forest
Rufa Red Knot	*Calidris canutus rufa*	BLM Sensitive and FWS Threatened		Shorelines
Sage Sparrow	*Amphispiza belli*	BLM Sensitive		Shrubland
Sage Thrasher	*Oreoscoptes montanus*	BLM Sensitive		Shrubland
Sprague's Pipit	*Anthus spragueii*	BLM Sensitive and Candidate		Grassland
Swainson's Hawk	*Buteo swainsoni*	BLM Sensitive		Grassland

Table 3-16
Special Status Species that May Occur within the Planning Area

Common Name	*Scientific Name*	*Federal Status*	*State Status**	*General Habitat*
Three-Toed Woodpecker	*Picoides tridactylus*	BLM Sensitive		Forest
Trumpeter Swan	*Cygnus buccinator*	BLM Sensitive		Wetland
White-Faced Ibis	*Plegadis chihi*	BLM Sensitive		Wetland
Willet	*Cataptrophorus semipalmatus*	BLM Sensitive		Grassland/wetland
Wilson's Phalarope	*Phalaropus tricolor*	BLM Sensitive		Grassland/wetland
Yellow Rail	*Coturnicops noveboracensis*	BLM Sensitive		Wetland
Fish				
Banded killifish	*Fundulus diaphanus*		SE	River/stream
Blacknose shiner	*Notropis heterolepis*		SE	River/stream
Blue sucker	*Cycleptus elongatus*	BLM Sensitive		River/stream
Longnose sucker	*Catostomus catostomus*		ST	River/stream
Northern redbelly dace	*Phoxinus eos*	BLM Sensitive	ST	River/stream
Pearl dace	*Margariscus margarita*	BLM Sensitive	ST	River/stream
Sicklefin chub	*Macrhybopsis meeki*	BLM Sensitive	SE	River/stream
Sturgeon chub	*Macrhybopsis gelida*	BLM Sensitive	ST	River/stream
Paddlefish	*Polyodon spathula*	BLM Sensitive		River/stream
Amphibians				
Plains Spadefoot	*Spea bombifrons*	BLM Sensitive		Grassland/wetland
Northern Leopard Frog	*Rana pipiens*	BLM Sensitive		Wetland
Reptiles				
Snapping Turtle	*Chelydra serpentina*	BLM Sensitive		Wetland
Spiny Softshell Turtle	*Apalone spinifera*	BLM Sensitive		River/stream
Greater Short-horned Lizard	*Phrynosoma hernandesi*	BLM Sensitive		Grassland
Prairie hognose snake	*Heterodon nasicus*	BLM Sensitive	ST	Grassland

Source: Consolidated from State of SD Natural Heritage list and BLM sensitive species list (2009).
*****SE = state endangered species; ST = state threatened species

The three terrestrial sensitive mammal species listed for South Dakota are the northern river otter (*Lontra canadensis*), swift fox (*Vulpes velox*), and the black-tailed prairie dog.

The **northern river otter**, documented within the planning area and associated with riverine habitat, is a species that is uncommon to the planning area but may be seen along the Missouri River or its tributaries. Efforts to reintroduce or re-establish the species in South Dakota in the past were limited to the Big Sioux River.

The remaining two species, the swift fox and the black-tailed prairie dog, are associated with prairie communities and are found in western South Dakota.

The **swift fox** is found within the planning area, with a small population in Fall River County in the southwestern part of the state and re-introduced populations in Badlands National Park in Stanley County in central South Dakota. Movement of individuals has also been documented across western South Dakota. The swift fox, which uses large tracts of short or mid-grass prairie for its habitat, was removed from the USFWS candidate species list in 2001.

Current management for this species is limited to application of Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) for maintaining and improving habitat. Habitat management opportunities for the swift fox could include options for reducing fragmentation to maintain currently intact priority grasslands, limiting the spread of invasive and exotic plants, reducing direct mortalities, and reducing disturbances at den sites.

Black-tailed prairie dogs today inhabit approximately two percent of their historic range within the planning area. The main causes for their decline have been poisoning and grasslands converted to cropland. Sylvatic plague has localized impacts to prairie dog populations. Prairie dogs are found in colonies in the open grasslands of the planning area, in most of the adjoining counties east and every county west of the Missouri River except Lawrence County. Prairie dog towns provide habitat for numerous vertebrate species, including other sensitive species such as the burrowing owl, swift fox, and black-footed ferret.

A statewide conservation plan for black-tailed prairie dogs was approved in 2005. Sylvatic plague was discovered in the black-tailed prairie dog population in Shannon County in 2005 and occurred in the Conata Basin ferret reintroduction area in 2008. In 2009, 44 black-tailed prairie dog towns totaling 1,978 acres were found on BLM-administered surface estate. In most cases, prairie dog towns located on BLM-administered surface state extend onto adjacent private, state, or other federal lands.

Sensitive Species – Birds

Thirty-seven bird species are considered sensitive by the BLM in the planning area, with almost all of them found on BLM surface or federal mineral, split-estate parcels. They include birds that use grasslands, water, or forested habitats. The following section discusses specific species or groups of species.

Grassland Birds

A majority of the 36 BLM sensitive bird species (Table 3-16) are associated with the grassland and sagebrush habitats of the planning area. The planning area has good habitat for a large number of the sensitive bird species that use the shrub steppe, short and midgrass prairie habitats, although they have had major declines in numbers throughout their range. The area is important to these species because of relatively intact tracts of habitat, in contrast to other parts of their breeding range, which is much more fragmented and where populations appear to be declining. Some acreages of native prairie within the planning area provide critical habitats for these sensitive and other prairie-dwelling bird species.

The planning area provides habitat for a group of sensitive bird species associated with grassland habitats, including willet (*Tringa semipalmata*), long-billed curlew, marbled godwit (*Limosa fedoa*), Wilson's phalarope, Sprague's pipit, dickcissel (*Spiza americana*), Brewer's sparrow (*Spizella breweri*), Baird's sparrow (*Ammodramas bairdii*), Le Conte's sparrow (*A. leconteii*), Nelson's sharp-tailed sparrow (*A. nelson*), McCown's longspur (*Rhynchophanes mccownii*), and chestnut-collared longspur (*Calcarius ornatus*). This group has exhibited a steep decline in numbers throughout their range (Knopf 1994) related to the changes in the Northern Great Plains.

The relative abundance of these species is determined by the frequency and extent of disturbance factors such as grazing, fire, and weather events. Historic grazing intensity and fire frequency were probably greater, resulting in a higher abundance of species that respond to shorter vegetation structure.

Current grazing management on many allotments which have stocking rates and pasture sizes that promote a range of vegetative structures across the landscape appear to support populations of a wide range of grassland bird species. Future management for grassland birds should preserve variation in vegetative structure in large blocks of native grasslands, minimize fragmentation of the remaining large blocks of habitat, and control the spread of noxious weeds.

Forest Birds

Nine BLM or state sensitive bird species inhabit the forest lands of the Black Hills and certain areas of Harding County. Northern goshawk, peregrine falcon, osprey, and bald eagle will be discussed under "Raptors." The remaining forest species include the American dipper (*Cinclus mexicanus*), veery (*Catharus fuscescens*), red-headed woodpecker (*Melanerpes erythrocephalus*), black-backed woodpecker (*Picoides arcticus*), and three-toed woodpecker (*Picoides tridactylus*). Forest habitats managed by the BLM also host migratory and migrating birds, all of which fall under the protection of the Migratory Bird Treaty Act (MTBA) regardless of whether or not they are on the BLM Special Status Species list.

The **American dipper** resides near clear, unpolluted, and fast-flowing streams. It nests along rock faces, on bridges, or similar structures, and will use man-made nest boxes specially designed and placed for dippers. American dippers forage for aquatic insects and small fish by walking or swimming underwater. The American Dipper has been petitioned for listing under the Endangered Species Act (ESA) in the Black Hills of South Dakota on several occasions; however, the USFWS issued a negative finding because dippers in the Black Hills do not constitute a Distinct Population Segment.

The **veery** is a thrush, more often heard than seen, that can be found in forested areas with a thick understory or brush. They forage mostly on the ground for insects, arthropods, fruits, and berries. Veeries are in slow decline across their range, likely due to nest parasitism by brown-headed cowbirds which is facilitated by forest fragmentation.

The **red-headed woodpecker** is more likely to be found at forest edges, in wooded riparian areas, and in shelter belts than in contiguous forest. The red-headed woodpecker is an aerial fly-catcher, but will also eat fruits, berries, and seeds. Red-headed woodpeckers are in decline across their range most likely due to habitat loss (Vierling & Lentile 2006).

The **black-backed woodpecker** is well adapted for and also heavily reliant upon recently burned forests. Their characteristic black dorsal plumage serves as camouflage as they forage on wood-boring beetles in charred trees post-burn. Their use of burned forests decreases as time since fire increases, making the nature of their habitat ephemeral and shifting. The Black Hills population of black-backed woodpeckers has been petitioned for listing as Threatened or Endangered, and the USFWS found, as of April 2013, that they may be warranted for further protection.

The **three-toed woodpecker** is similar in appearance and behavior to the black-backed woodpecker. It also forages on wood-boring insects that are often found in trees recently killed by flood or fire; however, three-toed woodpeckers have a weaker association with recent burns than do black-backed woodpeckers.

Raptors

Seven raptor sensitive species breed in the planning area on BLM lands. The Swainson's hawk (*Buteo swainsoni*), ferruginous hawk, golden eagle, and burrowing owl breed in grassland and sagebrush-grassland habitats, while the northern goshawk (*Accipiter gentilis*), osprey (*Pandion haliaetus*), and bald eagle require more forested areas. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests which vary somewhat, depending on which species is addressed.

The **bald eagle** occurs year-round in South Dakota and has made significant gains in breeding numbers throughout its range. Recently, pairs have been found nesting along the Belle Fourche River and other river drainages in western South Dakota. Bald eagle nests are increasing in the planning area as their population in South Dakota continues to expand westward along the major river drainages. The eagles that breed in the boreal forests of Canada and have migrated south can be found foraging across the planning area in the winter when they are often present near open water and waterfowl concentrations. More than 50 nesting pairs presently occur across South Dakota.

Bald eagles were removed from the federal threatened list in June 2007. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests. Important roost areas and other seasonal use areas, such as riparian areas, may also be protected with similar management actions.

The **osprey** is a summer resident in the Black Hills and migrant across most of the rest of the planning area. A small population nests in the Black Hills, but ospreys are very rare elsewhere in the state. Ospreys have been hacked

(reintroduced) along the Missouri River (Tallman et al. 2002). For more information regarding osprey reintroduction efforts in South Dakota and the final project report, please see https://gfp.sd.gov/wildlife/management/diversity/osprey-recovery.aspx.

The **northern goshawk** is a rare permanent resident in the Blacks Hills and Harding county and a rare migrant and winter visitor across the planning area (Tallman et al. 2002). The greatest potential for northern goshawks would be in the Exemption Area and other ponderosa pine habitats. No documented nesting territories occur on BLM-administered lands. Nesting habitat would be conifer or mixed forested areas. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests.

The **Swainson's hawk** is found statewide, with the largest concentrations in western South Dakota. A common migrant statewide and summertime resident in the north and west portions of South Dakota (Tallman et al. 2002), they are common nesters across the planning area. Nesting occurs in a tree, shrub, or on a cliff edge. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests.

The **ferruginous hawk** is a summer resident in western and north central South Dakota. This hawk is found on open mixed grass prairies and shrub steppe (Tallman et al. 2002). Nesting occurs on the ground in rolling grassland, in a tree or shrub, or on a cliff edge. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests.

The **burrowing owl** is a locally common migrant and resident in western South Dakota except in the Black Hills. It is uncommon elsewhere in the state (Tallman et al. 2002, Thiele 2012). Loss of grassland habitat to agriculture and elimination of burrowing rodents such as prairie dogs has contributed to their decline. Burrowing owls are found on prairie dog towns throughout the planning area (Thiele 2012).

The **golden eagle** is most common throughout the western portion of the state and a rare migrant and winter visitor to the eastern portion of the state (Tallman et al. 2002). Nesting occurs on cliffs or in trees. Current management focuses on seasonal and spatial limits on surface-disturbing and disruptive activities around nests.

Sensitive Species – Fish

Nine sensitive fish species live in the planning area, in the Missouri River and several of its tributaries. The species listed are banded killifish (*Fundulus diaphanous*), blacknose shiner (*Notropis heterolepis*), blue sucker (*Cycleptus elongates*), longnose sucker (*Catostomus catostomus*), northern redbelly dace (*Chrosomus eos*) x finescale dace (*Phoxinus neogaeus*) hybrid, paddlefish (*Polyodon spathula*), pearl dace (*Margariscus margarita*), sicklefin chub (*Macrhybopsis meeki*), and sturgeon chub (*M. gelida*). Further information, including distribution maps, may be found at http://gfp.sd.gov/wildlife/critters/fish/rare-fish/.

The **banded killifish** is found mainly in watersheds adjacent to the eastern side of the Missouri River; it is not known to exist west of the Missouri River in South Dakota. This species occurs in the eastern portion of the planning area but is not known to occur on BLM lands or is only marginally affected by BLM management.

The **blacknose shiner** is completely intolerant of turbid water and pollution. As lands surrounding prairie streams were disturbed and erosion increased the turbidity of streams and rivers, this species declined. The shiner exists only in a couple of streams in the south-central portions of the planning area and they are not known to occur on BLM lands or are only marginally affected by BLM management.

The **blue sucker** exists in South Dakota but mainly in the south-central and southeastern part of the state. The populations existing in the eastern portion of South Dakota would not be affected by BLM management of lands. The blue sucker may also occur in the Belle Fourche, Cheyenne, Grand, Bad, and White River watersheds within the planning area; however, they not known to occur on BLM lands or are only marginally affected by BLM management.

The **longnose suckers**, which grow to lengths of 18 inches, can be found in many of the clear, cold waters in the Black Hills including the Whitewood and Spearfish Creek watersheds in the northern portion of the Black Hills. The longnose sucker is found in portions of Whitewood Creek that traverse the Exemption Area near Lead and Deadwood.

The **northern redbelly dace** and the **finescale dace** are monitored as individual species in South Dakota by the SDNHP. However, the hybrid **northern redbelly dace x finescale dace hybrid** (*Phoxinus eos* x *P. neogaeus*) is not monitored, and it is unknown whether it exists in South Dakota. The known **northern redbelly dace** populations are found in spring-fed streams of the Big Sioux, Minnesota, Niobrara, and Crow Creek drainages in eastern South Dakota.

Considered rare in South Dakota, the **finescale dace** populations have been documented in Brule, Charles Mix, Fall River, Gregory and Lawrence counties. These species and the hybrid occur in the eastern portion of the planning area but are not known to occur on BLM lands or are only marginally affected by BLM management.

The **paddlefish** is found in the Missouri River and short distances up its tributaries in South Dakota. Paddlefish populations have declined mainly due to the loss of spawning habitat and the Missouri River dams that have blocked their movements. This species occurs in the planning area but is not known to occur on BLM lands or is only marginally affected by BLM management.

Pearl dace, a minnow that grows up to six inches long, prefers habitats with cool or cold water temperatures in deeper pools, as it does not use faster main currents. It has been found in the Little White River watershed, but it could be found in most of the major watersheds west of the Missouri River in South Dakota. The pearl dace is not common in the state and is considered a relic population. This species occurs in the planning area but is not known to occur on BLM lands or is only marginally affected by BLM management.

The **sicklefin chub** is a minnow that grows to four inches long. They prefer warm habitats and continuously and heavily turbid, large rivers with stable gravel and sand substrate. The fish's historic habitat has been altered by impoundments, but currently it has been found in the Grand River watershed and watersheds off of the Missouri River below the Lake Francis Case dam in south-central South Dakota. Also, it could be found in the Belle Fourche, Cheyenne, and White rivers. This species occurs mainly in the eastern portion of the planning area but are not known to occur on BLM lands or are only marginally affected by BLM management.

The **sturgeon chub** once historically inhabited the Little Missouri River and the Missouri River along with its western tributaries, the Grand, Cheyenne, and White rivers in South Dakota. This species was found in large, turbid river channels that have a strong current, riffle areas, and a sand or fine-gravel substrate. The species occurs in the planning area but is not known to occur on BLM lands or is only marginally affected by BLM management.

Sensitive Species – Amphibians and Reptiles

Two amphibian and four reptile species are listed as Montana/Dakotas BLM sensitive species in the planning area (Table 3-16). No current management actions are directed at specific amphibian or reptile species in the planning area, but management actions directed at improving broad-scale habitat conditions through the Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM 1997a) are expected to maintain and improve habitat.

Management opportunities include increased surveys to determine presence and habitat associations for sensitive species amphibians and reptiles in the planning area and minimizing impacts to known habitats caused by invasive and exotic species, decreased water quality, and disease. Improvements to specific habitats important to some species may also be considered. Following is a detailed description of the sensitive amphibian and reptile species.

Amphibians

The **plains spadefoot toad** (*Spea bombifrons*), which inhabits grassland and floodplain areas with sandy or loose soil, is sporadically distributed throughout western South Dakota. This species is not known to occur on BLM surface but may exist on federal mineral estate lands.

The **northern leopard frog** (*Rana pipiens*) is South Dakota's most familiar frog and is found throughout South Dakota in a variety of habitats from temporary wetlands to large lakes. Populations in the planning area appear to be healthy. They are known to occur on BLM surface and federal mineral estate lands. Though they are considered a Sensitive Species in the

Montana/Dakotas, leopard frogs are not known to be in decline in eastern Montana and the Dakotas. Rather, their status is of concern mostly in the western parts of Montana.

Reptiles

Spiny softshell turtles (*Apalone spinifera*) inhabit large rivers with adequate areas of slack water and sand bars. These turtles lay their eggs in sandy soil or sand and gravel bars near water. Impacts to the nesting habitat include invasive and exotic vegetation, livestock concentrations, and changes in water flow patterns due to dams and water diversions. In South Dakota, these turtles prefer the natural-flowing portions of the Missouri River and its larger tributaries. Within the planning area, they inhabit the Belle Fourche, Cheyenne, and Missouri rivers.

The **snapping turtle** (*Chelydra serpentina*) is highly aquatic and an omnivore. It is found mainly in permanent water with soft mud bottoms and aquatic vegetation across South Dakota. This species inhabits aquatic areas across the planning area.

The **Western hog-nosed snake** (*Heterodon nasicus*) generally uses open prairies or sandy areas near floodplains or water where they will burrow in grasslands with well-drained soils. It specializes in feeding on salamanders, frogs, and toads. Occasionally observed and found throughout the planning area, this species can be easily overlooked.

The **short-horned lizard** (*Phrynosoma hernandesi*) is a ground-dwelling reptile that inhabits semi-arid shortgrass or sagebrush prairies with rocky or sandy areas. This species is distributed over the northwest and southwest corners of South Dakota, inhabiting many of the butte and badland areas of BLM surface and also is likely to occur in split-estate mineral areas.

BLM Sensitive Plants

The BLM Montana/Dakotas State Director designates sensitive plant species within the BLM Montana State Office jurisdiction, which include those species for which there is a concern for population viability, species that could become candidates for listing, and locally rare species. The South Dakota Field Office will use the most current list of sensitive species from the State Office, and a new list will supersede all previous lists.

White-veined wintergreen (*Pyrola picta*) is a sensitive plant species that occurs within the Black Hills. This plant is a perennial forb that has a global rank of G4G5. Forested areas in the Exemption Area contain suitable habitat, and plants have been documented in several locations on BLM-administered lands in this area.

Dakota buckwheat *(Eriogonum visheri)* is a sensitive plant that grows on sparsely vegetated badland outcrops and alluvial outwash in badlands terrain in western South Dakota. This is an annual forb that has a global rank of G3 and a state rank of S3. A possible specimen of this plant was collected on BLM-administered land in Perkins County in 2007. A positive identification of this collection was not possible due to the condition of the plant. Specimens of Dakota buckwheat were identified at sites in Pennington and Perkins counties in 2013. Locations, photos, and other pertinent habitat information were collected and sent to the South Dakota Natural Heritage Program. Multiple plants were found at these locations, and plants appeared to be in good health.

South Dakota Rare Plants

The South Dakota rare plant list is compiled and tracked by the South Dakota Natural Heritage Program. The South Dakota rare plant list contains plants that have limited distribution or occurrences in South Dakota.

The South Dakota rare plants listed in Table 3-17 have been documented close to BLM land or occupy similar types of habitat that is known to exist on BLM-administered land.

Table 3-17
State of South Dakota Rare, Threatened, or Endangered Plants
Tracked by the South Dakota Natural Heritage Program (November 2009)

Common Name	*Scientific Name*	*Global Rank*	*State Rank*	*Comment*
Orange Mountain-dandelion	*Agoseris aurantiaca*	G5	SU	Reported from nw Black Hills.
Green Spleenwort	*Asplenium viride*	G4	S2	Limestone outcrops and soil of n Black Hills.
Marsh Alkali Aster	*Aster pauciflorus*	G4	SH	Last collected in 1959 in nw SD.
Rattlepod	*Astragalus americanus*	G5	S3	Forested riparian zones of Black Hills.
Barr's Milkvetch	*Astragalus barrii*	G3	S3	Regional endemic including sw SD.
Hair Sedge	*Carex capillaris*	G5	S3	Moist Black Hills habitats and historically in ne SD.
Low Northern Sedge	*Carex concinna*	G4G5	S2S3	Reported but rarely collected in the Black Hills.
Delicate Sedge	*Carex leptalea*	G5	S3	Forested wetlands of higher Black Hills
Inflated Sedge	*Carex vesicaria*	G5	SH	Several historical collections from nw, sw, ne SD.
Douglas' Dusty Maiden	*Chaenactis douglasii*	G5	SU	Western species found in nw SD.
Pale Coral-root	*Corallorhiza trifida*	G5	S2	Cool, moist forests at higher elevations of the Black Hills.
American Rock-brake	*Cryptogramma acrostichoides*	G5	S1	Single collection in 1994 from n Hills rock outcrops.
Northern Comfrey	*Cynoglossum virginianum* var. *boreale*	G5T4T5	S3	Various forested habitats of the Black Hills.
Drops of gold	*Disporum hookeri*	G5	S2S3	Aspen/birch and mixed forests of n Black Hills.
Interrupted Wildrye	*Elymus diversiglumis*	G3G4Q	SH	Last collected in 1969 from woodlands of Black Hills.
Dakota Buckwheat	*Eriogonum visheri*	G3	S3	Badland outcrops of w SD, sw ND and se MT.
Sidesaddle Bladderpod	*Lesquerella arenosa* var. *argillosa*	G5T3	S3	Regional endemic of badlands in sw SD.
Broad-lipped Twayblade	*Listera convallarioides*	G5	S1	Few occurrences in springhead wetlands of n Black Hills.
Hairy Woodrush	*Luzula acuminata*	G5	S2S3	Restricted to boreal forest types of n Black Hills.
Small-flowered Woodrush	*Luzula parviflora*	G5	S2S3	Few collections in the n Black Hills.
Round-branched Ground Pine	*Lycopodium dendroideum*	G5	S4	Restricted to n Black Hills.
Great Basin Navarretia	*Navarretia intertexta* var. *propinqua*	G5T5	SH	Two historical collections from Harding Co.
Alpine Timothy	*Phleum alpinum*	G5	S2	Higher elevations of the cent and n Black Hills.
Bahia	*Picradeniopsis woodhousei*	G4G5	SU	Two 1967 collections from w SD.

Table 3-17
State of South Dakota Rare, Threatened, or Endangered Plants
Tracked by the South Dakota Natural Heritage Program (November 2009)

Common Name	*Scientific Name*	*Global Rank*	*State Rank*	*Comment*
Northern White Orchid	*Platanthera dilatata*	G5	S1	Rare in wetland habitats of the n Black Hills.
Round-leaved Orchid	*Platanthera orbiculata*	G5	S3	Forested habitats of the n Black Hills.
Northern Holly-fern	*Polystichum lonchitis*	G5	S2	Moist forested habitats of n Black Hills.
White-veined Wintergreen	*Pyrola picta*	G4G5	S3S4	Higher elevation forests of the n Black Hills.
One-flower Wintergreen	*Pyrola uniflora*	G5	S2	Mature spruce forests of the n Black Hills.
Shining Willow	*Salix lucida*	G5	S1	Single recent collection from cent Black Hills.
Bloodroot	*Sanguinaria canadensis*	G5	S4?	Forests of e SD and disjunct in Black Hills.
Western Saxifrage	*Saxifraga occidentalis*	G5	S2	Few collections from n Black Hills.
Sand Puffs	*Tripterocalyx micranthus*	G5	S1	Sand prairie and blowouts of nw SD.
Mountain Huckleberry	*Vaccinium membranaceum*	G5	S2	Restricted to forests in Lead/Deadwood area.
Great-spurred Violet	*Viola selkirkii*	G5?	S2S3	Moist forests at higher elevations of the Black Hills.
Woody Aster	*Xylorhiza glabriuscula*	G4	S1S3	Seleniferous soils of sw SD.

Fish and Aquatics

The BLM uses its aquatic surveys and those done by SDGFP to help assess the abundance, distribution, and health of fish populations and aquatic habitat within the planning area. Key indicators of environmental conditions for fish and aquatic habitats are water quality (such as temperature and sediment) and other elements critical to aquatic and riparian habitat and suitable fish habitat, including water volume and temperature and the presence or absence of non-native competitors.

As noted in the riparian vegetation section, BLM surface estate contains 54 miles of major riparian areas that are present on BLM-administered land within the planning area. Of the areas assessed, the study indicated that 68 percent (37 miles) of riparian areas on BLM-administered lands in South Dakota are in Proper Functioning Condition (PFC). Thirty percent (16 miles) are Functional at Risk (FAR) and two percent (one mile) are Non-Functioning (NF).

Fisheries and aquatic habitat include reservoirs and perennial and intermittent streams and rivers that have the capability of supporting fish. Within the planning area seven major rivers dissect western South Dakota and then flow into the Missouri River: the Little Missouri, Grand, Moreau, Belle Fourche, Cheyenne, Bad, and White Rivers. The BLM manages scattered land parcels within the floodplain of the Little Missouri, Cheyenne, Moreau, and Grand Rivers. Many intermittent prairie streams are important and support several species of fish.

Management for improved fishing opportunities on BLM-administered lands along river and stream systems with fisheries is limited because of the scattered pattern of land ownership in the planning area. In addition, most BLM tracts are located along one side of the river or stream system.

The Cheyenne and Little Missouri rivers support modest warm water fisheries with very limited angling opportunities. The BLM tracts along these fisheries are small tracts averaging 72 acres in size. BLM-administered surface estate is present along eight and one-fourth miles of the reach of the Cheyenne River that flows from the Angustora Reservoir tailwaters downstream to the confluence of the Belle Fourche River. There is also BLM-administered surface estate along nine and one-fourth miles of the Little Missouri River in northwest Harding County. Total miles of BLM-administered lands along both rivers include 18 miles in 38 tracts in the sections of these rivers that have fishery potential (Table 3-18). Low flows and extremely limited public access limits public fishing opportunities on BLM-administered lands in these areas. While these rivers do not provide good angling opportunities, they do provide habitat for a variety of fish and aquatic species.

Table 3-18
Summary of BLM-Administered Lands Along Prairie River and Stream Fisheries

River or Stream	***Miles of BLM-Administered Surface Estate along Riverbank***	***County***
Cheyenne River from Angustora tailwaters downstream to the confluence of the Belle Fourche River	8.25	Meade, Pennington, Custer, and Fall River
Little Missouri River	9.25	Harding
Missouri River (island or river bank)	5.00	Sully, Stanley, Bon Homme, Gregory, Charles Mix and Yankton
Total	**22.50**	

Small tracts of BLM-administered surface estate are present in the Missouri River reservoirs and in some cases, along the freeflowing sections of the Missouri River between reservoirs. For the purposes of this discussion these waters are considered river fisheries. Although most of these lands are submerged, six tracts of BLM-administered surface estate in Stanley, Sully, Bon Homme, Gregory, Charles Mix and Yankton counties are located in such a manner that these lands would be considered river bank or islands except during periods of high flow. Total miles present is currently estimated to be approximately five miles of BLM-administered surface estate along the river banks and islands of the Missouri River, although the amount varies depending on flow levels of the river (Table 3-18). While the Missouri River and its reservoirs contain high quality fisheries, extremely limited public access limits public fishing opportunities on BLM-administered lands in these areas.

In and near the Exemption Area, approximately two miles of BLM-administered public land is located along the upper reaches of Whitewood Creek and three-quarters of a mile of BLM-administered public land is located along Bear Butte Creek in the Fort Meade Recreation Area ACEC (Table 3-19). While access is available to these areas, the quality of fishing opportunities is moderate to low as a result of low flows.

Table 3-19
Summary of BLM-Administered Surface Estate Along Black Hills Streams with Fisheries

River or Stream	***Miles of BLM-Administered Surface Estate along Streambank***	***County***
Whitewood Creek	2.00	Lawrence
Bear Butte Creek	0.75	Meade
Total	**2.75**	

Reservoirs in the BLM planning area vary in size from less than one acre to up to 40 acres. Except during periods of prolonged drought, some of the perennial structures hold transplanted fish. Some springs are also found in the planning area, mostly in and around the Black Hills.

The vegetated floodplains along these rivers and streams dissipate stream energy and filter silt loads. As mentioned in the previous section, water qualities such as temperature, sediment, and dissolved oxygen affect fisheries habitat.

Public lands within the planning area provide habitat for 34 species of native fish and 12 species of introduced fish; the entire planning area contains 96 native and 37 introduced fish species (Hoagstrom et al. 2011). Amphibians and aquatic invertebrates are also components of the aquatic communities. See Table 3-16 in the Special Status Species section for a list of aquatic species on the BLM sensitive species list.

Cultural Resources

Legislative Framework

The National Historic Preservation Act of 1966, as amended, provides specific guidance to federal agencies that must consider potential effects to cultural resources as part of the agencies' management activities. These guidelines or protocols are found in Section 106 of 36 CFR 800, Protection of Historic Properties. Federal agency programs are also mandated by policies and standards set forth in the National Environmental Policy Act of 1969; Federal Land Policy and Management Act of 1976; Archaeological Resource Protection Act of 1979; the American Indian Religious Freedom Act of 1978; Native American Graves Protection and Repatriation Act of 1990. Executive Orders include, 11593, Protection and Enhancement of the Cultural Environment; 13007, Providing for American Indian and Alaska Native Religious Freedom and Sacred Land Protections; 13084, Consultation and Coordination with Indian Tribal Governments, 13175, Trails for America in the 21st Century; and 13287, Preserve America, The BLM provides additional guidance for the management of cultural resources in Manual Sections 8100, 8110, 8120, 8130, 8140, 8150, 8160, 8170, and Handbooks H-8120-1 and H-8160-1.

Affected Environment

The BLM is responsible for managing cultural resources located on public lands or on non-federal lands affected by BLM undertakings and manages these lands according to direction outlined in the regulations and statues listed above. Responsibilities include identifying, protecting, and enhancing cultural resources. Cultural resources are evidence of past human behavior, and may include archaeological, historic, and architectural properties, as well as properties important to traditional lifeways of Indian groups as identified through historic research and consultation with tribes. An archaeological site is a place (or group of physical sites) in which evidence of past activity is preserved. It can be investigated through the science of archaeology and provide a record of happenings in our prehistory, history, and recent past. Important or unique information about past societies and environments can provide answers for certain social and conservation problems today.

BLM land management in South Dakota includes three categories: surface only (274,239 acres), minerals only (commonly referred to as subsurface split-estate) (1,715,677 acres), and surface and subsurface land in 37 counties (refer to Map 1-1 and Table 1-1).

Most BLM surface-management parcels are west of the Missouri River, with the exception of Brule, Marshall and Campbell counties. Nearly all BLM surface parcels cover subsurface BLM mineral lands. Several counties adjoining or near the east bank of the Missouri are managed for small amounts of subsurface minerals only. Concentrations of BLM-administered lands in South Dakota occur in the northwestern portion of the state (Harding, Perkins, Butte, and Meade counties), in the Black Hills (Lawrence County and western portions of Custer, Pennington, and Fall River counties), the area bordering the Pine Ridge Indian Reservation to the north (eastern Custer and Pennington counties and northwestern Jackson County), and the central Missouri River (Stanley, Hughes, Jones, and Lyman counties).

Description and Summary of Cultural Properties within the Planning Area

As of July 2008, BLM surface occupancy lands within South Dakota contained 266 recorded cultural properties representing a wide variety of site types and ages. They include 195 prehistoric archaeological sites and 61 proto historic and historic archaeological sites, along with 10 that represent both prehistoric and historic resources as recorded in the state records inventory at the South Dakota Archaeological Research Center (Table 3-20). Split-estate lands (BLM subsurface) contain another 1,672 recorded archaeological sites (Table 3-21).

Table 3-20
Summary of Archaeological Sites on BLM Surface Lands in South Dakota (2008)

	Site Types			*NRHP Status*			
County Code	*Historic*	*Prehistoric*	*Both*	*Unevaluated*	*Not Eligible*	*Eligible*	*Listed*
BF	2	0	0	2	0	0	0
BU	5	8	0	11	2	0	0
CU	4	84	2	35	55	0	0
DW	0	1	0	1	0	0	0
FA	2	17	5	17	7	0	0
HK	1	1	0	0	2	0	0
HN	0	16	0	15	1	0	0
LA	22	0	0	7	11	4	0
MD	21	51	3	29	39	4	3
PN	0	13	0	3	10	0	0
ST	0	2	0	1	1	0	0
ZB	4	2	0	6	0	0	0
Totals	**61**	**195**	**10**	**127**	**128**	**8**	**3**

Table 3-21
Summary of Archaeological Sites on Split-Estate Lands in South Dakota (2008)

	Site Types				*NRHP Status*			
County Code	*Historic*	*Prehistoric*	*Both*	*Unknown*	*Unevaluated*	*Not Eligible*	*Eligible*	*Listed*
BU	25	148	3	6	121	59	2	0
CU	32	420	17	6	318	132	19	6
FA	23	255	18	7	227	69	5	2
HK	1	2	0	1	4	0	0	0
HN	25	143	0	16	135	42	4	3
HU	0	4	0	1	1	4	0	0
JK	3	39	0	0	24	17	1	0
JN	10	0	1	0	4	7	0	0
LA	36	2	0	0	10	18	10	0
LM	28	4	0	0	13	18	1	0
ME	27	78	6	15	79	37	7	3
PN	44	162	4	8	153	57	7	1
PE	2	5	0	0	5	2	0	0
ST	22	15	5	3	21	19	2	0
Totals	**278**	**1,277**	**54**	**63**	**1,115**	**481**	**58**	**15**

BLM lands in South Dakota do not contain any structures included in the South Dakota historic sites inventory. Most of these archaeological and historic sites were identified through professional surveys, in advance of projects involving federal funds, and in accordance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). Other archaeological and historic sites were identified during earlier work by the Smithsonian Institution's River Basin Surveys program or were reported by the public or researchers.

The State of South Dakota's archaeological and historic sites inventories do not include traditional cultural properties (TCPs) and American Indian sacred sites. Many tribal councils and individuals prefer keeping information about such places out of the public eye in order to protect their sanctity and the privacy of worshippers. To avoid negative impacts to such places, agencies and cultural resources managers need to consult directly and in detail with tribal councils, tribal historic preservation officers, and sometimes with any others who have knowledge of local history.

Cultural resources are identified through field inventories conducted by qualified professionals to comply with Section 106 of the NHPA. Cultural resource managers recognize three levels of field inventories or archaeological surveys: Class I, Class II, and Class III. BLM Manual Section 8100, Glossary describes the cultural resource inventory classes as follows:

Class I - existing data inventory: a study of published and unpublished documents, records, files, registers, and other sources, resulting in analysis and synthesis of all reasonably available data. Class I inventories encompass prehistoric, historic, and ethnological/sociological elements, and are in large part chronicles of past land uses. They may have major relevance to current land use decisions.

Class II - sampling field inventory: a statistically based sample survey designed to help characterize the probable density, diversity, and distribution of archaeological properties in a large area by interpreting the results of surveying limited and discontinuous portions of the target area ("reconnaissance survey").

Class III - intensive field inventory: a continuous, intensive survey of an entire target area, aimed at locating and recording all archaeological properties that have surface indications, by walking close-interval parallel transects until the area has been thoroughly examined. Class III methods vary geographically, conforming to the prevailing standards for the region involved. Most Class III surveys are done before activities involving federal funds. As noted above, federal law requires that archaeological and historic properties within a federal project area be identified and evaluated for their significance before the project actually begins.

At present, 24,611 of the 274,345 acres of BLM surface holdings in South Dakota have undergone Class II or III archaeological survey since 1982. (Earlier surveys are not considered valid for site identification and evaluation purposes.) Of minerals-only (subsurface) lands, 187,275 acres have been surveyed of the total of 1,715,677 acres. Currently, nine percent of BLM surface lands and 11 percent of the subsurface lands have undergone Class II or III survey since 1982. (Survey areas do not include USFS lands.)

Approximately 10 percent of the surface and split-estate BLM lands have been inventoried for cultural resources, resulting in a recorded density of one site per 175 acres. This site figure is an approximation because the cultural sites are not randomly distributed across the landscape. Instead they are more numerous in some areas than in others. Furthermore, areas previously surveyed for cultural resources on BLM lands in South Dakota have been limited to areas that have been proposed for development, rather than representative of the landscape.

Historic Overview

According to academic research of archaeological, ethnographic, and historic records, human history in what is now South Dakota began with the Paleo-Indian period, dated at 12,500 to 7,000 radio carbon years ago (Holliday 1999). The earliest Paleo-Indian period in the state includes the Clovis and Goshen complexes (Hannus 1985 and 1990, Fosha 1997, Donohue 2003 and 2004, Donohue and Hanenberger 1993, and Sellet 1999). If earlier cultures existed in South Dakota, no record of them has yet appeared (however, see Fosha and Woodside 2003). The Clovis and Goshen complexes represent people who lived by hunting mammoth, *Bison Antiquus*, and other Pleistocene animals. On the Northern Great Plains, these sites date between 11,300 and 10,700 Before Present (BP). These three complexes (Clovis, Goshen, and Folsom) appear to indicate small, highly mobile nomadic groups with highly developed chipped-stone tool technologies. Few sites other than animal

kill sites have yet been excavated in the Northern Great Plains. By 10,600 BP, when the subsequent Folsom complex had become widespread, the mammoth was extinct and people focused their attention on bison.

Apart from their most visible activity – butchering large animals – we know little of the lifeways of these pioneer Plains dwellers. One Clovis site in Montana was an infant's grave (Owsley and Hunt 2001) which contained many beautifully crafted stone and bone tools and was covered with red ocher. Caches of stone tools, blades, and meat suggest a strategy of stashing emergency supplies to avoid shortages of necessities within a territory. Goshen and Folsom in the Northern Plains seem to be local groups based in mountain-foothills zones with occasional forays into the open plains for bison hunting (Stiger 2005). By contrast, Clovis sites occur most often in plains areas and contain tool stones, indicating movement through very large territories. Several Folsom sites are known in South Dakota (Noisat 1990 and Sellet 1999).

The later Paleo-Indian period includes a large number of complexes, recognized primarily by their distinctive projectile point types, dating 10,500 to 7000 BP (Frison 1991). These include the Agate Basin, Hell Gap, Alberta-Cody, Scottsbluff-Eden-Cody, and Frontier complexes, the latter including Angostura, Jimmy Allen, Pryor Stemmed, and Lovell Constricted projectile-point types. All these complexes occur in South Dakota (Toom 1991 and 1994, Tratebas, 1986, Muniz 2005). These complexes represent nomadic bison hunting groups based in the open plains, as well as groups with more diverse food sources and smaller territories (Frison and Stanford 1982, Frison 1991, and Bamforth et al. 2005). Some of these moved from high to low altitude areas with the seasons and used a wide variety of plants and animals. In the open plains, Paleo-Indian groups sometimes made mass bison kills by surrounding herds and driving them off escarpments or into narrow canyons.

The trend toward regional diversity continued throughout the subsequent Archaic period (1500 to 7000 BP), which is divided into the Early, Middle, and Late Archaic periods. The Early Archaic (5500 to 7000 BP) marks the transition from the relatively moist and mild climate of the terminal Pleistocene to the much drier and more extreme climate of the Holocene (Frison 1991). Bison were evolving into a smaller form, and pronghorn were thriving in the dry western basin and range country. All Great Plains groups still relied heavily on hunting but were increasingly developing seasonal migration patterns and technologies that allowed them to use a greater diversity of resources. Sites dating to this period are rare, due at least in part to instability of the land surface during this dry time (Frison 1991). Diverse food remains and large, side- or corner-notched dart points used with an atlatl (spear-thrower) characterize Early Archaic sites in South Dakota and the Northern Plains (Alex 1991, Donohue et al. 1995, Hannus et al. 1997, Sundstrom et al. 1999, and Fosha 2001).

By the Middle Archaic period (3500 to 5500 BP), local groups appear to have been moving through well-defined territories according to a seasonal schedule of hunting and foraging activities (Tratebas 1986, Keyser 1985, and Greiser 1985). These groups had developed effective technologies for storing meat and plant foods, which probably allowed them to winter over in pit houses, at least during severe weather (Larson 1997). Middle Archaic sites are abundant in western South Dakota and include periodically reused campsites, bison kill sites, and several kinds of burial sites (Wheeler 1957, Gant and Hurt 1965, Tratebas and Vagstad 1979, Buechler 1984, Keyser and Davis 1984, Metcalf and Black 1985, Haberman 1985, Noisat 1990b and 1992, Sundstrom 1989, Alex 1991, Sundstrom et al. 1994, and Donohue et al. 1995). A few sites have been identified on the Missouri and in eastern South Dakota, as well (Lehmer 1981, Hannus and Winham 2004; and Toom and Steinacher 1980). During this period, the climate returned to moister conditions and sedimentation increased. The erosional forces that appear to have removed much of the Paleo-Indian and Early Archaic record lessened or stopped, and the Middle Archaic record is well preserved throughout most of the state. In the Northwestern Plains, the Middle Archaic is represented by the McKean Complex, which includes middle-sized, basally notched dart points of various styles.

The Late Archaic period (1500 to 3500 BP) saw the development of several new cultures in the state. At first, the Pelican Lake Complex and other, unnamed complexes held sway. These were similar to the McKean Complex that preceded them. Later in the period, the Besant Complex, a bison hunting-based culture, appeared. It may have derived in part from Eastern Woodland groups that had migrated up Great Plains rivers during "the Woodland period." These immigrants may have initiated the long-standing pattern of eastern Missouri River-based tribes traveling west in the summer and fall to hunt and obtain resources such as tool stone and eagle feathers. The first secure evidence for use of tipis comes from the Late Archaic period and coincides with a renewed emphasis on bison hunting. During this time, continued moist, mild conditions permitted bison populations to increase.

About 1000 to 2000 BP, Woodland Pattern cultures along the major rivers overlapped with the Late Archaic and Late Prehistoric transition period in western South Dakota. The Woodland groups probably lived in small, semi-permanent settlements, perhaps in simple wattle-and-daub houses. They lived by gathering plant foods, hunting waterfowl and deer, and probably tending patches of edible plants. They made pottery and constructed large and small mounds, some containing burials, throughout eastern South Dakota (Haberman 1979 and 1993, Neuman 1960 and 1975). These groups would eventually develop into, or merge with, the larger, complex village farming sites of the Plains Village tradition (Lehmer 1971, and Tiffany 1983 and 2007).

The Plains Village tradition in South Dakota varied over time and space but was generally characterized by clusters of earth-covered timber houses with each housing several nuclear families, a plaza for public gatherings, and agricultural fields on the river bottoms owned by extended matrilineal family groups. Many of the villages were fortified to ward off attacks by enemy raiders seeking the valuable dried corn supplies there. Farming provided much of the diet, as well as items for trade. Large hunting parties ventured west from the villages in late summer to obtain the year's meat supply. These groups also trapped fish in the rivers near the villages. Various villages and nations merged and split into separate groups as their populations fluctuated and threats from enemy raiders increased or abated. This flexible political organization allowed the Plains Village groups to survive droughts, enemy assaults, and rapid population expansions. These groups emerged in historic times as the Mandan, Hidatsa, Arikara, Ponca, Omaha, and Cheyenne.

The Late Prehistoric period, which saw the introduction of the bow and arrow in the Northern Great Plains beginning about 1,500 years ago, is marked by the Avonlea complex (Hannus and Nowak 1988, Sellet and Fosha 2007, and Frison 1991). Nomadic bison hunting was the rule during this period, with groups living in small, dispersed tipi camps throughout most of the year and gathering into large interband encampments in the summer for trade and ceremonies. The Late Prehistoric period of western South Dakota was dominated by highly mobile groups supported by hunting and foraging (Lippincott 1996 and Saunders et al. 1994).

After 800 BP, farming groups expanded into the Middle Missouri River region from the middle Mississippi and lower Missouri rivers. These groups alternated between large earth-lodge villages in the summer months and small tipi camps in sheltered locations in the winter. Their principal subsistence activity was farming corn, beans, and squash. For part of the summer and fall, large hunting parties would travel far to the west into what is now northwestern South Dakota in search of bison and other resources, while other members of the group remained behind at the village to tend the crops. These Middle Missouri settlements were part of the Plains Village Tradition. Their sites were characterized by large, semi-permanent villages; large earth lodges; cache pits for storing corn, dried meat, and other supplies; and many distinctive types of pottery. Some of the villages had defensive structures such as stockades, moats, and bastions.

According to historic and ethnographic accounts, during the Late Prehistoric and Protohistoric periods, the ethnic makeup of the planning area underwent a series of changes. Between the early fifteenth and late eighteenth centuries, western South Dakota was controlled sequentially or concurrently by the Mandan, Hidatsa, Arikara, Crow, Naishan Dene (Kiowa Apache), Eastern Shoshone, Arapaho, Cheyenne, and Lakota. The last three of these groups entered the area in the late eighteenth century after the introduction of the horse. Formerly farming peoples from the upper Midwest, these groups abandoned settled village life for nomadic, equestrian bison hunting.

By the mid-nineteenth century, the area was dominated by the Lakotas but was still used by many of the other groups. The Hidatsa, Mandan, Arikara, and Ponca were based in earth-lodge villages along the Missouri, James, and Big Sioux rivers and the lower reaches of their tributaries. Parties from these nations visited western South Dakota on a seasonal basis for hunting and eagle trapping. By 1849, non-Indians had also begun moving through the Great Plains along the emigrant trails and were starting to encroach on lands claimed by the American Indian nations. Wars resulted from these episodes of ethnic expansion, some between American Indian tribes, and others between alliances of tribes and the Euroamericans.

Non-Indians began to explore what is now South Dakota in the mid-1700s. By 1800, French and Spanish traders had begun to establish posts along the Missouri River, trading metal tools and other factory goods for pelts and bison robes. Traders had reached the Black Hills by the time the Lewis and Clark Expedition passed through central South Dakota in 1804. The fur trade flourished the first half of the nineteenth century. By then, the Indians were well armed with weapons of European and American manufacture and well supplied with horses from the Southwest. The Indians now fielded formidable forces of mounted warriors. While their main focus was intermittent raiding and horse-stealing from enemy Indians, they quickly adapted their tactics to controlling white emigrant parties and the military forces dispatched to protect them. By 1857, the

fur trade was over, the Dakotas and Poncas were on reservations, and the first white settlements reached eastern South Dakota. A period of rapid town building ensued east of the Missouri, but western South Dakota remained closed to white settlement for another two decades. The Dakota Territory was carved out of the much larger Nebraska Territory in 1861 and was again reduced in size to present day North and South Dakota in 1868.

The Dakota War of 1862 began when a group of Dakotas under Little Crow attempted to resist confinement to reservations and the resulting economic collapse that had brought the band to starvation and also to drive white settlers from southern Minnesota. They killed around 490 white settlers and in turn lost 71 of their own, with another 277 arrested and 38 executed. Although the revolt was quickly suppressed, some 25,000 settlers fled the region. Some of the refugees and the Indian prisoners ended up in eastern South Dakota.

During the 1860s, the Lakotas and their allies in the West succeeded in limiting white settlers to the Oregon Trail and defeated the military forces intent on keeping trails open to the new Montana gold fields. The 1868 Treaty of Fort Laramie established the Great Sioux Reservation in the western part of what is now South Dakota. The treaty was short-lived because rumors of gold in the Black Hills led to public agitation for the U.S. government to open western Dakota to exploration and settlement. Following the 1875-1876 gold rush and the U.S. government's taking the Black Hills in 1877, settlers flooded into western South Dakota.

As the federal government's philosophy in the Black Hills shifted from eviction of trespassers to protection of the mining frontier, temporary military posts were established to protect areas from Indian attack (Miller 1987: 11). Historic military forts in South Dakota include Fort Pierre Chouteau, Fort Rice, Fort Sully, Fort Sisseton, Fort James, Fort Randall, Fort Dakota, and Fort Meade, to name a few of the most prominent military forts in South Dakota that were instrumental in the expansion of the Western Frontier. The most noteworthy in the BLM planning area is Fort Meade, of which BLM administers 6,574 acres of the former Military Reserve surrounding the Fort.

In 1878 Fort Meade was established to provide the necessary protection of transportation routes, and communities in and surrounding the Black Hills. Troops from Camp Sturgis, at the base of Bear Butte, then moved to this permanent garrison (Bradford 1978). The fort functioned as a training ground for military expeditions throughout a large part of the state's history. Fort Meade housed many mounted Calvary units along with infantry companies through the 1920s; then progressed to mounted-motorized units that were largely half mounted and half motorized units. Fully motorized infantry units eventually took over post-WWI (Bradford 1978). In 1906 the White River Band of the Southern Ute Tribe left the Uintah Reservation in Utah to seek refuge with the Sioux Indians. Over 400 Ute members were persuaded to surrender and were escorted to a camp at Fort Meade, which they occupied into 1907 when Fort Meade soldiers escorted them to Thunder Butte on the Cheyenne River Reservation (Lee 1978:6). From 1933 to 1935 the Calvary Unit at Fort Meade assumed camp supervision over all Civilian Conservation Corps (CCC) in the State. A tent city to house 1,000 CCC workers was erected at Fort Meade (Krause 1978: Chapter 3).

German prisoners of war were held at CCC Camp Fechner on Fort Meade from 1944-1946. These prisoners worked on nearby farms harvesting and handling crops and aided construction projects at the Fort. In early 1944 the last U.S. Army troops, other than those who guarded the prisoners of war until January 1946, were withdrawn and the buildings and grounds were turned over to the Department of Veterans Affairs. The National Guard started training at Fort Meade as early as 1914, and continues training there today. In 1956 the BLM acquired all of the old military reservation, except for 700 acres retained by the Department of Veterans Affairs which still has some of the original fort buildings and a veterans hospital and care facility. Fort Meade's vast military presence can still be seen in the obvious ruins of horse cavalry jumps, firing and gunnery ranges, and a large artillery range.

Other important historic highlights of Fort Meade include stabling Comanche, one of the last horses left standing after the Little Big Horn Battle; the initiation of the Star Spangled Banner as the National Anthem, and record breaking high altitude balloon flights.

Although western South Dakota had been open for non-Indian settlement since 1877, most of the area outside the Black Hills remained open range until about 1890. Large cattle companies brought in Texas cattle; other outfits ran sheep. By 1884, some 700,000 to 800,000 cattle grazed the western South Dakota ranges, but severe winters in the late 1880s killed

many thousands (Lee and Williams 1964). By 1890, open-range cattle driving ended, but large cattle outfits continued to operate ranches in the area.

In the western part of the state, most of the land remained in public ownership, with several large Indian reservations lying west of the Missouri. Forest reserves were established in the Black Hills, Cave Hills, Short Pine Hills, and Slim Buttes. National Grasslands were eventually created in many locations west of the Missouri River. National parks and monuments were established in the Black Hills (Wind Cave and Jewel Cave) and in the Badlands. Large tracts of state land were reserved for Custer State Park in the Black Hills and the state antelope preserve in Harding County.

The majority of the planning area is historically and presently utilized for ranching, and farming. Historically, dry-farming was practiced throughout the West. As a means of watering crops, many private irrigation companies were established to construct small diversionary works such as canals and diversion dams to increase the number of farms and the yield of these farms. In western South Dakota, local companies such as these controlled irrigation works including the Red Water Canal, five miles above the confluence of the Red Water and Belle Fourche rivers; the Edgemont Canal, on the Cheyenne River 15 miles above the town of Edgemont; and the Cascade Ditch on Cascade Creek (McCune 2001: 6).

The most prominent irrigation system in the project area is the Belle Fourche Project, an irrigation system constructed by the Bureau of Reclamation to provide water to dry land farms in hopes of bringing more population and farmers to the area. It started with facilities such as a diversion dam, two primary canals, and the Belle Fourche Dam (formerly called Orman Dam). Approximately 94 miles of irrigation canals and 450 miles of irrigation laterals were constructed to irrigate 57,068 acres of farmland near the towns of Newell, Nisland, and Vale (McCune 2001 (2-3)). Later when irrigation practices did not take into consideration proper drainage of the associated soils and lands became contaminated with salts due to seepage of subsoils, up to nearly 4,000 acres became un-irrigable (21-22). As a remedy 232 miles of drains were installed as corrective action to the contamination (2).

Reclamation constructed the Willow Creek extension from 1921 to 1922, which extends across a large portion of BLM surface land (18). Additional plans for upgrading the willow creek extension were not completed due to a decrease in federal funding. The Willow Creek extension is labeled the Willow Creek Lateral on topographic maps inside the BLM-administered area. It is unknown if this portion of the irrigation system was ever constructed far enough for full irrigation utilization in the project area.

Statehood was attained in 1889, and eastern South Dakota experienced a series of booms and busts from 1890 to 1940. New settlers, often immigrants from Europe, were lured by promises of rich farmland nearly free for the taking, only to be hit by droughts that ruined all possibility of profitable farming. The eastern part of the state ultimately developed a pattern of small hamlets supplying mid-size wheat farms, with larger cities and towns serving areas comprising several counties. In eastern South Dakota, most land was plowed for wheat and other grain crops. Agriculture remains the principal industry, although tourism and light manufacturing are important in some communities.

Cattle ranching continues as the main private enterprise in western South Dakota. As family ranches replaced the large outside cattle interests, towns like Buffalo and Belle Fourche were established as market centers. The main period of town building in northwestern South Dakota took place after 1910. Cattle and sheep ranching remain the principal industries in the area today, although oil and gas extraction are gaining importance.

Archaeological and Historic Sites in South Dakota

As of 2010, approximately 19,000 archaeological sites are known in South Dakota. These sites generally represent hunting and animal processing, temporary residence, tool stone gathering and working, mounds, earth lodge villages, homesteading, stock-raising, eagle trapping, and religious activities. Sites are categorized in South Dakota as: alignment, artifact scatter, burial, cabin, cairn, dam, depression, dump, earth lodge village, earthwork, farmstead, fort, foundation, hearth, industrial, isolated find, kill, mine, monument, mound, nonfarm ruins, occupation, quarry, rock art, rock shelter, railroad, road, school foundation, stone circle, townsite, trading post, village, and well/cistern. Other categories or subcategories may include bison or antelope bone beds, eagle-trapping pits, tool stone procurement and tool manufacture, stone alignments, vision quest locales, and timber lodges.

The distribution of archaeological sites of the Prehistoric and Protohistoric periods is geographically patterned. Woodland and Plains Village sites, including mounds, are largely confined to the major rivers of eastern and central South Dakota. Stone circles and artifact scatters that may represent campsites and food processing areas occur in valleys, on toe slopes, and on mesa tops. Bone beds from game drives occur in deep soils of draws, alluvial fans, and toe slopes. Vision quest markers, cairns, and eagle-trapping pits occur on the rimrocks, while rock art is common in the overhangs below the rims and on other more resistant sandstone outcroppings. Localities with deeper soils, including alluvial fans, valley floodplains, mesa tops, and rock overhangs, often contain buried, deeply stratified sites that have the greatest scientific potential for both archaeological studies and research on past environmental conditions. The entire post-glacial period is represented, but sites dating to the Late Archaic and Late Prehistoric, including Plains Village periods, are by far the most common, likely because earlier sites have been lost to erosion.

Historic sites are more evenly scattered throughout the state, with farmsteads more common in the east and ranches in the west. Mining sites are found primarily in the Black Hills. The 1944 Flood Control Act or the Pick-Sloan Plan initiated Missouri River dams in Montana, North Dakota and South Dakota. The dams were constructed for a variety of reasons including flood control, hydropower development, irrigation, navigation and water supply for municipal, rural and industrial purposes.

Important military sites in the planning area also include underground Minuteman Missile sites and the Black Hills Army Depot and Igloo Townsite. The Black Hills Army Ordnance Depot (BHAD) was a munitions storage and maintenance facility formerly operated by the Ordnance Corps of the United States Army. The BHAD was established and constructed in 1942 to help meet the Army's increased ordnance handling needs caused by World War II. Nearly all of the facility's civilian workforce lived in federally owned housing at the depot; this residential community was known as Igloo, a name derived from the characteristic shape of the munitions storage buildings constructed at the site. The Igloo community included public schools, a hospital, post office, church, and shopping and entertainment facilities including a theater, swimming pool and a recreation center. The level of employment at BHAD varied over the years, increasing during periods of war. During typical peacetime periods of the 1950s, between 700 and 750 workers were employed at the site. BHAD was renamed "Black Hills Army Depot" in 1962. The Depot was closed in 1967 and the Igloo community was abandoned. A large number of former Depot buildings still remain at the site and are privately owned (http://www.igloo-sd.com accessed July 31, 2011). Concerns about possible inadequate handling and disposal of hazardous materials at BHAD have resulted in some superfund actions.

Approximately 150 Launch Facilities (LF) and fifteen Launch Control Facilities (LCF) for Minuteman Missile silos were constructed in Western South Dakota in the fall of 1961, during one of the most volatile periods of the Cold War. The Minuteman I Intercontinental Ballistic Missile (ICBM) construction program out of Ellsworth Air Force Base led construction efforts until November 1, 1963, when all three missile squadrons of the 44th Strategic Missile Wing were declared combat ready. For nearly thirty years, the missiles were maintained on constant 24-hour strategic nuclear alert. The 44th Strategic Missile Wing was inactivated on July 4, 1994 and the missile silos were systematically deactivated and demolished. The government obtained permanent easements for the LF and LCF sites along with their access roads. A few of the of the missile silo sites on larger parcels of BLM-administered land were retained by the BLM, and the rest were sold. In 1999 the US Congress designated two missile sites, Delta 1 and Delta 9 as Minuteman Missile National Historic Sites. The sites, located east of Wall, South Dakota, are being preserved as Cold War historic sites by the National Park Service (http://www.nps.gov/mimi/historyculture/index.htm).

Ethnically, American Indian-related sites are found throughout the state, with historic-era sites concentrated on the reservations. From 1879-1910, large numbers of Norwegians, Swedes, Danes, and Finns settled throughout the state, with concentrations in the southeastern and northwestern counties. About one-third of the white settlers in South Dakota were Scandinavian. German-Russians came between 1873 and 1885, settling in the north central and southeastern counties. Among them were Mennonites and Hutterites who formed colonies in Turner, Hutchinson, and Bon Homme counties. Germans from Germany arrived at about the same time but dispersed throughout the state. Czechs, Bohemians, and Dutch settled in an area of south-central South Dakota straddling the Missouri River. (Several books provide overviews of South Dakota history; see Kingsbury 1915, Lee and Williams 1964, Karolevitz 1975, Nelson 1986, Schell 2004, and Thompson 2005.)

Cultural Resources – Conditions and Trends in South Dakota

Cultural resources are a finite, nonrenewable resource. Once a site is damaged, looted, or destroyed, it cannot be put back into its original condition. Besides deliberate or unintentional damage from human activities such as construction, irrigation and other water control projects, oil and gas development, mining, housing developments, looting and vandalism, archaeological sites are susceptible to damage from natural weathering, erosion, animal activity, and the like. While land managing agencies can try to minimize damage to cultural resources, they generally cannot repair or restore a damaged resource. This means that cultural resources are inevitably declining in condition and number. Site conditions thus trend toward fewer resources and fewer intact (undamaged) resources over time.

The condition and trend of site preservation in South Dakota vary by region and within regions according to land use and natural setting. Causes of damage listed on site forms include looting, vandalism, road and dam construction, minerals exploration and mining, natural erosion, plowing and other farming activities, wildfire, cattle trampling (especially around water tanks), and land development for housing and commercial uses. By far the biggest loss to South Dakota's archaeological resource base has been the destruction of sites along the Missouri River due to reservoir construction and maintenance and related bank erosion.

Comprising one of the richest archaeological zones on the North American continent, the Middle Missouri archaeological region has been devastated by large hydroelectric dam projects beginning in the 1950s. Entire villages were bulldozed or inundated; others that remained perched on the higher terraces back from the dams are now eroding into the river at an alarming rate. In addition, cultural sites in eastern South Dakota occurring at or near the surface have been widely damaged by agricultural activities such as plowing. In the western part of the state, the surface is generally more intact, but this area has experienced large-scale mining that has also resulted in damage or loss of many archaeological and historic sites.

As mentioned previously, common prehistoric archaeological site types in South Dakota are lithic artifact scatters, earth-lodge villages, stone circles, short-term camp sites, cairns, rock art, and tool stone quarries. Less common are animal bone concentrations resulting from game drives, vision quest stations, eagle-trapping pits, stone alignments, and scatters of artifacts that include ceramics or factory-made trade goods. Well-stratified, multiple-component sites have been found in rock shelters, remnant alluvial fans, stream terraces, spring deposits, and in the terraces lining the Missouri, James, and Big Sioux rivers.

Common historic archaeological sites in the state are the remains of claim shacks, dumps, schools, churches, roads, railroad grades, trails, trading posts, and military forts. The South Dakota Historic Sites Inventory provides information on known historic structures, historic districts, cemeteries, and bridges. The information contains properties that are listed or considered eligible for listing on the National Register making them historic properties. Some have been determined not eligible for listing on the National Register and some have not yet been evaluated. Common historic sites and districts are courthouses, churches and missions, parks, ranches, homesteads, schools, libraries, commercial districts, cabins and sod houses, community halls, bank buildings, depots, fairgrounds, dams, and college buildings. The most common types of properties in the inventory are bridges and residential housing.

Within South Dakota, demand for access to and use of cultural resources varies from moderate to high. On the high end of the demand spectrum are places such as Bear Butte, which is heavily used both for outdoor recreation and for religious traditional use by a large number of American Indians. Bear Butte has also been the focus of geological and biological research because of its unique origins and biota. The lower slopes have been used for cattle grazing and hay fields. Some of these uses, such as traditional use by Indians, reflect the mountain's cultural significance, while others such as geological research and agriculture are incidental to it.

Interest in cultural resources by the public is demonstrated by the success of "archeo-tourism" at such places as the Mitchell Site Archeodome, Fort Sully, Farm Island visitor center, and Fort Pierre-Choteau in South Dakota. Just outside the state boundaries are other places where the public can view archaeological sites: Pipestone National Monument and the Jeffers Petroglyphs in Minnesota, the Knife River Indian villages in North Dakota, the Hudson-Meng Site and Fort Robinson in Nebraska, and the Vore Buffalo Jump and Medicine Lodge Creek State Park in Wyoming. Grant-funded research projects have been conducted at many archaeological sites in South Dakota, including the Ice Cave and Kenzy Sites, the Deadwood Chinatown sites, and several Plains Village sites along the Missouri River.

American Indian traditionalists have maintained connections to places containing edible and medicinal plants, rock art, grave sites or places used for tree or platform "burials," minerals and plant products used in rituals or for paints, and vision quest stations. Indians and non-Indians alike are interested in visiting the sites of battles, old trading posts, and ghost towns to learn more about these aspects of their history. In addition to these culture-related activities, outdoor recreation, tourism, research, and economic activities place a demand on areas containing significant cultural resources.

Special Designations

The Fort Meade Recreation Area is designated as an area of critical environmental concern (ACEC) for its cultural resource values. (See a discussion of the ACEC in the Special Designations section.) Listed on the NRHP, the fort has the potential to be listed as a National Historic Landmark. In order to be listed a property must meet specific criteria for the National Register of Historic Places:

(a) are associated with events that have made a significant contribution to the broad patterns of our history; or
(b) are associated with the lives of persons significant in our past; or
(c) embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
(d) have yielded, or may be likely to yield, information important in prehistory or history.

Sacred and Traditional Use Sites in South Dakota

Tribal consultations are required to identify places actively used or valued by today's American Indians in the area. Archaeological and ethnographic information indicates that Indians from the Crow, Cheyenne, Lakota, Dakota, Nakota, Assiniboine, Hidatsa, Mandan, Arikara, Kiowa, Kiowa-Apache (Naishan Dene), Omaha, and Ponca nations have lived within what is now South Dakota. Tribal oral history pertaining to the prehistory and history of South Dakota differ from the Historic Overview presented above.

Among major landforms that were historically revered by American Indian groups are Spirit Mound, the Coteau des Prairies, Thunder Butte, Bear Butte, Buffalo Gap, the Black Hills, the Traverse des Sioux (the pass between Big Stone Lake and Lake Traverse), and Snake Butte near Pierre. The following site types also fall into the category of sacred sites: mounds, rock art, stone alignments, vision quest stations, some caves, burials, and ceremonial grounds. Every area of the state contains some places considered sacred by American Indians, as indicated by historic documents and/or tribal consultations.

Treaty Rights and Traditional Values

BLM coordination or consultation with Native Americans, as it pertains to treaty rights and trust responsibility, is conducted in accordance with the following direction:

- Bureau Manual Handbook H-8160-1 – General Procedural Guidance for Native American Consultation (Washington Office Information Bulletin No. 95-57; November 15, 1994).
- 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; April 29, 1994).
- 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 (Article 6, Clause 2). Treaty rights are not gifts or grants from the United States, but are 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 Indian tribes constitute the chief source of present day federal Indian law. In addition, the American Indian Religious Freedoms Act of 1978 (P.L. 95-341) and Executive Order 13007 of 1996 (Indian Sacred Sites) require federal agencies to make reasonable accommodations for Native American individuals and groups to conduct and participate in religious activities on public lands. This includes access to public lands, protection of the integrity of sacred places, and restricting public access to information about sacred places and traditional use sites.

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 Native American groups. The traditional value of primary concern to land managers is a respect for the land and places where American Indian ancestors once lived.

Cultural Resources Use Categories

BLM land use planning policies assign cultural resources to "use categories" for appropriate treatment and protection. Each category calls for a particular level of site preservation; thus, an accurate and reasonable definition of each use category is important to effective site management. The categories are: scientific use; conservation for future use; traditional use; public use; experimental use; and discharged from management. (1) Under the Scientific Use categories, sites are preserved until their research potential is reached. (2) The Conservation for Future Use category encompasses sites that will be preserved until stated conditions for use are met. (3) A Traditional Use designation calls for long-term preservation of sites. (4) A Public Use designation also calls for long-term preservation, as well as interpretive materials. (5) Under Experimental Use, sites are protected until used. (6) Sites are also placed into a Discharge from Management category which have no, or very limited, historic or archaeological value. Each use category is defined below to indicate how site characteristics and management action are related under this system.

Scientific Use: The sites included in this category have the potential to yield information important to an understanding of past lifeways, technology, beliefs, migration, economic systems, and other aspects of history, archaeology, or anthropology. This information potential will only be achieved through additional research. While no exact menu of site characteristics can cover every situation, the following characteristic are necessary for a site to be placed in the Scientific Use category:

- The site can yield information about aspects of past lifeways, events, and trends that is not likely to duplicate that of other sites. For example, study of a tool stone quarry might help archaeologists understand how people and objects moved through the landscape and it might reveal how people acquired valuable resources within or outside of their home areas.

- The site will yield new information only through additional research. This applies to sites with subsurface features or artifacts or material that requires specialized analysis, such as radiocarbon dating samples or seeds from food processing features.

- The archaeological or historic site typifies remains of one or more periods or activities, such as a Homestead Era claim shack and outbuildings. The site does not have to provide an unusual or spectacular example, but provides information about mainstream trends and activities.

- The site contains information not available elsewhere. An example would be a well stratified, multiple component site that occurs in an area where other sites are shallow and lack separation between the components.

- The site is sufficiently intact to yield useful information.

- With few exceptions, the site is eligible to the National Register of Historic Places under Criterion D, likely to yield information important in history or prehistory.

Sites that do not qualify under Scientific Use are generally small, lack subsurface deposits or features, are not likely to yield new information, and are common in the area. Examples would be small lithic scatters, surface sites that lack features, and building or corral ruins that do not have artifacts on or below the surface. Sites that are so badly damaged that researchers cannot gain useful information from them also do not qualify.

Sites placed in the Scientific Use category are managed so that the information they contain can be gleaned through surface mapping or excavation. They are managed for protection until such research can be completed, but they are not managed for long-term preservation.

Conservation for Future Use: This category encompasses sites that should be preserved for long-term use other than, or in addition to, research. Examples are highly complex archaeological sites reserved for future study as new research tools are developed. All sites in this category are eligible to the NRHP under Criterion A, B, C or D (see Table 3-22). Sites in the Conservation for Future Use category are managed for long-term preservation. To achieve this, they must be listed on the National Register or officially designated as NRHP-eligible.

Traditional Use: Sites included in the Traditional Use category are important to American Indians or other ethnic, religious, or cultural communities as places used for activities such as burials, ceremonies, vision quests, and medicinal or edible plant-food gathering areas. These activities are important to the groups' beliefs or identity. These sites are identified through consultation with tribal representatives and may or may not be NRHP-eligible. If they are eligible, they generally qualify under Criterion A or D, but possibly could qualify under Criterion B or C. Such sites are usually managed for long-term preservation if tribal representatives deem such preservation important to maintaining their traditional cultural values.

Public Use: This category is used for sites that are appropriate for public visits and interpretation. They have characteristics such as high visibility that lend themselves to public education. Most sites are NRHP-eligible. Sites in the Public Use category are managed for long-term preservation. Additionally, they are developed for public education through interpretive signs, brochures, tours, and the like.

Experimental Use: These sites are unlikely to yield information beyond that gathered through their initial recording and evaluation. They are generally small, single-component sites that resulted from a single prehistoric or historic use. They are of a common site type and lack potential for interpretation or other public education activities. Examples are short-term historic dumps or low density surface lithic scatters. Such sites are unlikely to be NRHP-eligible. Sites in the Experimental Use category are not managed for long-term preservation. They are considered for experimental use only if the information they contain does not go beyond that already collected during survey and evaluation, they are not appropriate for public education, and they are not important to the identity and values of American Indian groups.

Discharge from Management: Sites included in this category have no, or very limited, historic or archaeological value. They are unlikely to yield new or useful information and have little or no potential as interpretive sites. Examples are prospect pits on mining claims, artifacts found outside of their original place of deposition, and isolated artifacts not associated with more extensive surface or subsurface sites. As the name suggests, sites in the Discharge from Management category require no preservation management. Managers need not take any measures toward their preservation other than properly maintaining maps and records to indicate what the sites contained. These sites are not eligible for NRHP listing.

Determining the Correct Use Category

Classifying cultural sites by Use Category requires sufficient knowledge of the site to know the following: whether the materials it contains have been moved through erosion; whether it has been damaged, and if so, whether this damage has compromised the scientific integrity of the site (that is, its condition in regard to maintaining useful information); whether the site contains subsurface deposits; what density and types of artifacts and associated remains it contains; whether it contains features; how many strata (layers of deposits) it contains; whether the strata containing artifacts and features overlap or are vertically separated from one another; the horizontal extent and vertical depth of the artifact-bearing deposits; and what kinds of information the site is likely to provide if scientifically studied.

Some sites will fall under more than one Use Category. In such cases, the highest level of protection indicated for the various relevant categories is applied. For example, a rock art site might be classified simultaneously under Scientific Use, Conservation for Future Use, Traditional Use, and Public Use. It qualifies under Scientific Use because advanced recording techniques and research are likely to yield new information important to an understanding of who made and used the petroglyphs or pictographs, when they were made, what motivated their creation and use, and how they encode information. The site qualifies under Conservation for Future Use because of its exceptional historic value. It qualifies under Traditional Use because historic and ethnographic documents show that petroglyph sites were traditionally used as vision quest stations,

shrines, and gathering places and were viewed as places where people could gain power or advice from supernatural beings. The site would qualify for Public Use because its high visibility, unique setting, and cultural information provide good opportunities for visitors to learn more about the past cultures and natural history of the area. In this case, the site would be managed for long-term preservation, while also accommodating use by researchers, American Indians, and the public.

Three Use Category models follow. The first, Table 3-22, is a chart from a BLM environmental impact statement (BLM Dillon RMP 2006). The table summarizes the five use categories and the types of historic and archaeological resources placed in each. The second, Figure 3-11, is a flow chart that shows the process from NRHP eligibility status to Use Category placement. The third, Table 3-23, is a matrix that lists various site attributes with the appropriate Use Category.

View from Harding County Butte BLM Photo

Table 3-22
Summary of BLM Use Categories

Cultural Resources Use Category	*National Register Eligibility**	*Preservation Strategy*	*Site Types Generally Included*
Scientific Use	Usually eligible under Criterion D	Long-term preservation not critical; medium NRHP nomination priority	Prehistoric sites with high artifact count and diversity, high complexity, or large size; historic sites with archaeological and historic values and generally poor structural integrity. Examples: bison processing site, stratified campsite, and historic mine complex.
Conservation for Future Use	Always eligible (usually under Criteria D, A, or C, but possibly B)	Long-term preservation required; highest NRHP nomination priority; standing structures require stabilization	Inherently complex or rare prehistoric sites subject to loss or damage; sites with high scientific values; inherently complex or rare historic sites, especially standing structures subject to loss or damage. Examples: stone quarry; deeply stratified, large site; and standing ranch buildings.
Traditional Use	May be eligible under Criteria A or D, possibly B or C	Long-term preservation is desirable; nomination priority is set after tribal consultations	Sites and locations determined in consultation with tribes. Examples: burial locations, vision quest stations, rock art, some tipi ring sites, plant-gathering areas, and cave shrines.
Public Use	Usually eligible, generally under Criteria A, B, or C, possibly D	Long-term preservation is desirable; high NRHP nomination priority	Prehistoric and historic sites with high interpretive potential and for which protection or adaptive reuse is practical. Examples: historic ranger station and prehistoric bison kill site.
Experimental Use	May be eligible under Criterion D	Preserve until data are extracted; low NRHP nomination priority	Prehistoric and historic sites with low artifact density, and lack of complexity. Examples: collapsed building and lithic artifact scatter.
Discharge from Management	Not eligible	Not preserved or nominated to NRHP	Prehistoric and historic sites with little or no potential for additional data. Examples: isolated finds and prospect pits.

* Cultural Resource Management typically determines whether specific properties are eligible for listing on the National Register of Historic Places. There are four criteria for determining eligibility that examine whether the property qualifies:

Criterion A: associated with broad patterns of the past, for example, a farm house that was part of the Underground Railroad for escaped slaves;

Criterion B: associated with historically important persons, for example, Monticello being associated with Thomas Jefferson;

Criterion C: an example of historically important design or artistic merit, for example, a through truss highway bridge; or

Criterion D has the potential to yield important information on prehistory or history, for example, an archaeological site that can yield information about prehistoric Native American lifeways.

Figure 3-11
Flow Chart for Determining Archaeological Site Use Classification

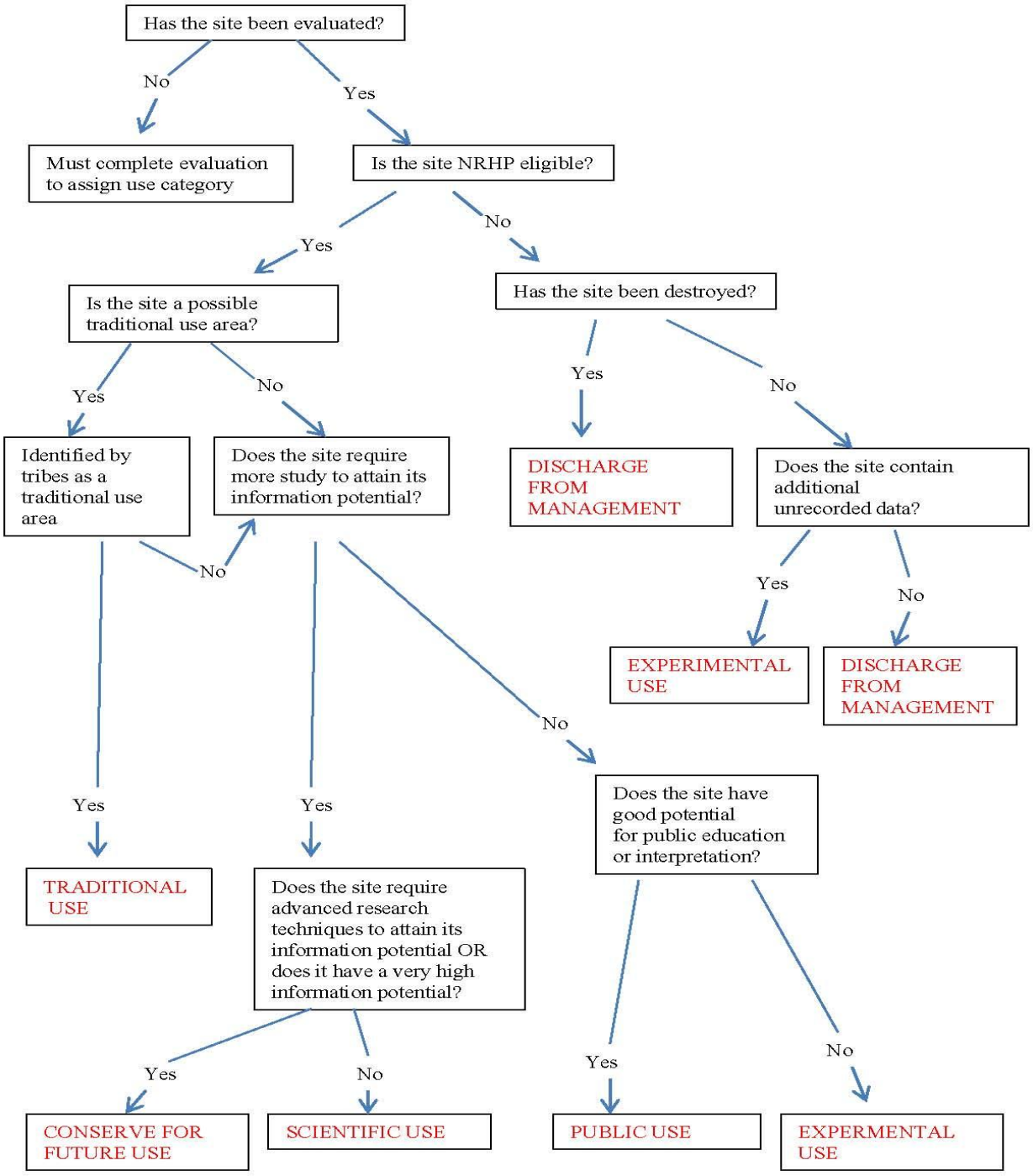


Table 3-23
Site Attribute-Based Use Category (Classification Matrix)

*Site Deposition**	*Site Contents*	*Size, Complexity, Potential for Chronology*	*Use Category*
Surface Only	No features and fewer than 50 artifacts		Discharge from Management
Surface Only	No features and more than 50 artifacts		Experimental Use
Surface Only	Contains features	Site is small and simple	Experimental Use
Surface Only	Contains features	Site is large or complex	Scientific Use or Conserve for Future Use
Surface Only	No artifacts or features in context	No datable materials	Discharge from Management
Surface Only	No artifacts or features in context	Has datable materials	Experimental Use
Subsurface, Single Component	Contains no features and only one type of artifact	No datable materials and nothing complex or rare	Discharge from Management
Subsurface, Single Component	Contains no features and only one type of artifact	No datable materials but has complex or rare artifact assemblage	Experimental Use
Subsurface, Single Component	Contains no features and only one type of artifact	Has datable materials, but nothing complex or rare	Experimental Use
Subsurface, Single Component	Contains no features and only one type of artifact	Has datable materials and complex or rare artifact assemblage	Scientific Use
Subsurface, Single Component	Contains features or more than one type of artifact	No datable materials and site is simple and small	Experimental Use
Subsurface, Single Component	Contains features or more than one type of artifact	No datable materials, but site is large and complex	Scientific Use or Conserve for Future Use
Subsurface, Single Component	Contains features or more than one type of artifact	Site has datable materials and is large or complex	Scientific Use or Conserve for Future Use
Subsurface, Multiple Component	Components are mixed and cannot be separated		Experimental Use
Subsurface, Single Component	Components have adequate separation	Site contains no features, datable materials, or complex or rare artifact assemblages	Experimental Use
Subsurface, Single Component	Components have adequate separation	Site contains features, datable materials, or complex or rare artifact assemblages	Scientific Use or Conserve for Future Use

*In the field of archaeology, site deposition refers to the natural and cultural processes results in object being left in the ground.

Prehistoric Resources

Generally, sites that will be considered for Conservation or Scientific Use include any well-stratified buried site, any site that has numerous or unusual features, and any site with good potential for yielding information about past environment and climate. Such sites ought to be preserved until researchers can realize their information potential through detailed study that may involve new or developing research methods.

Many sites in this category are classified as "artifact scatters." Approximately 56 percent of known cultural resource sites on BLM surface land in the planning area are artifact scatters. Since this category includes a wide variety of site types from simple clusters of stone tool-chipping debris lying on the surface to deep, stratified sites of great complexity, it is imperative to treat the ubiquitous "artifact scatter" as a high potential site until it has been formally evaluated through test excavation. Site age is also a factor because older sites are rarer than recent ones. A Paleo-Indian artifact scatter may warrant protections and research that would not be appropriate for a more recent site. A Paleo-Indian house feature of any sort, whether it is a tipi ring or a house pit, would deserve preservation. Other prehistoric sites that warrant long-term care and study are rock art sites, earth-lodge villages, mounds, and boulder effigies.

Traditional Use sites may include rock art sites, sacred sites, vision quest stations, and areas where the dead were "buried," whether by exposure on scaffolds or in trees or by interment. Apart from these general categories and the specific sacred and Traditional Use sites listed above, it will be the decision of tribal elders and preservation officials to identify those places they deem important for traditional beliefs and activities. The sites most promising for the Public Use category in South Dakota are rock art sites and other highly visible sites, such as large earth-lodge villages. Large bison-bone kill sites may have good visibility and interpretive potential. Forts, trading posts, and battlefields are of high public interest and reflect important developments in the history of the state. The route of Lewis and Clark is also of interest to the public and lends itself to interpretive materials such as roadside exhibits and markers.

Site types that are common, lack potential for datable materials, or are damaged or destroyed can be placed in the Experimental Use category. Their potential for information can be met through small-scale studies or test excavations. Such sites as artifact scatters that cannot be dated, sites with few features or artifacts, and those dating to later periods and that are well represented in the archaeological record can all be placed in this category.

Sites that have been destroyed or mostly destroyed can be placed in the Discharge from Use category. Prehistoric isolated finds and surface lithic scatters with less than 50 items, with no potential for related buried deposits or exceptional exotic materials, are other sites that can be considered for Discharge from Use.

Historic Resources

Sites that lack standing structures may still be appropriate for long-term preservation (Conservation Use) or Scientific Use if they represent rare settlement types, have high potential to yield new information, or are good examples of a particular kind of land use. Examples would be the remains of a religious colony, squatters' homesteads on federal lands (not recorded in deed books), and the headquarters buildings of a large cattle company.

Traditional Use sites would include the sites of county fairs, Indian encampments, rodeos, and places used during the Reservation Era for plant food gathering, Sun Dance camps, hunting, or vision questing.

Public Use sites could be developed in conjunction with major research projects; however, a site with no standing structures otherwise lacks the visibility and historic value needed for Public Use. Exceptions would be battlefields and historic transportation routes, such as the Bismarck-Deadwood and Yankton-Black Hills stagecoach routes.

Sites with standing structures can make effective Public Use sites and can warrant long-term preservation efforts. Those associated with important historic events such as the Slim Buttes battlefield; historic trends such as the Homestead Era or fur trade; or ethnic enclaves such as the Hutterite colonies of eastern South Dakota have good interpretive potential. One of the newest national parks (Badlands National Park, established in 1978) is built around a missile silo from the Cold War era near Wall, South Dakota. The CCC camps (1933-1942) may also lend themselves to interpretive exhibits.

Sites such as homesteads, trash dumps, sheep camps, and other common types can be placed in the Experimental Use category unless they contain rare or especially representative material that would benefit from detailed excavation and analysis.

Historic sites that have been destroyed can be placed in the Discharge from Use category. Other consideration for Discharge from Use would be historic isolated finds, dumps with less than 50 items or that are less than 50 years old.

Current Demand and Use of Cultural Resources

Within the planning area, the Fort Meade Recreation Area continues to be an area of considerable public use. Public lands containing prominent geologic features such as the isolated buttes in Harding County are potentially areas of high use when access to the features is provided. If the Homestake Powder Houses within the Exemption Area are adaptively reused to provide recreational housing, the buildings and their surroundings would transition to a high use area.

Paleontological Resources

Resource Characterization

The BLM has managed fossils as a valued public land resource for many years. Legal authority to manage fossils comes from a variety of laws, executive orders, and policies. The laws include the National Environmental Policy Act of 1969 (NEPA) and the Federal Land Policy and Management Act of 1976 (FLPMA). More recently, the Paleontological Resources Preservation subtitle of the Omnibus Public Land Management Act of 2009, also known by its popular name, the Paleontological Resources Preservation Act (PRPA), directs land managers within the Department of the Interior Agencies and the U.S. Department of Agriculture, but not including either Indian or Military (Department of Defense) lands, to manage and protect fossils using scientific principles and expertise.

According to Section 6301 of PRPA, 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 USC 470aaa). Such remains include body fossils such as shells and bones, as well as trace fossils such as footprints, burrows, trails, or other evidence of an organism's presence. Fossils are preserved in rocks and are usually discovered when they are eroding out of the rock at the surface, or during ground-disturbing activity such as road grading or trenching. Most individual organisms that lived in the past did not die in such a way as to have their remains fossilized, and fewer still will be collected and studied before they erode away. Therefore fossils are considered rare and nonrenewable.

Regional Context

Fossils are found in geologic formations. The geologic formations present in the western part of the SDFO RMP planning area extend into several of the neighboring states and Canada, with only minor sedimentary or depositional differences. Many of the same formations can be found in eastern Montana, northeastern Wyoming, northwestern Nebraska, western South Dakota and North Dakota, and southernmost Saskatchewan and Manitoba.

In western South Dakota and northeastern Wyoming, tectonic forces pushed up the Black Hills. Erosion exposed older metamorphic rocks in the core of the uplift leaving younger sedimentary rocks from the Paleozoic and Mesozoic (Triassic and Jurassic) to ring the uplift. Cretaceous-aged rock covers much of the rest of the western portion of the state. The sediments that eroded from the Black Hills uplift were deposited primarily to the east and southeast, covering the older Cretaceous and Paleocene formations, adding to the Eocene strata, and finally forming the mid-Tertiary Oligocene and Miocene formations that dominate the landscapes from the Black Hills to Badlands National Park, into northwestern Nebraska and elsewhere. Toward the east, these latest Cretaceous/early Tertiary formations "feather out," and a sequence of increasingly older sediments progress toward the center of South Dakota.

East of the Missouri River, the surface geology is characterized by glacial sediments, including deposits from a large glacial lake that formed near the margins of the last continental glacial episode. A few exposures of Cretaceous shales and igneous rocks appear in some places east of the river as well.

The geologic formations in the Black Hills represent an extensive period of time, from the granitic/metamorphic core up through a sampling of most of the major time periods. Much of the Black Hills area is not BLM-administered land, but small windows into many of these time periods are preserved in scattered tracts around the margins of the Black Hills, as well as in the Exemption Area surrounding the cities of Lead and Deadwood.

The Late Cretaceous/early Tertiary formations in the northern Great Plains region are world renowned for their dinosaur and early mammal fossils; most of the major museums in the United States have fossils from this region. The younger Eocene/Oligocene/Miocene formations have also produced a huge number of significant mammal fossils over the last 130 years. Research done in the area that is now set aside as Badlands National Park and on the formations of similar age outside the park in South Dakota and Nebraska formed the early underpinnings of the science of paleontology as it is known today. Several classic publications about the paleontology of these formations have been written, some dating back to the 1870s.

Classification of Potential

Fossils are found in rocks. The rocks that we see today were formed over millions, and sometimes billions, of years. When the animal or plant that we find today as a fossil was alive the environmental conditions of that location were significantly different. For example, the rock that fossils are found in today may have been formed by sediments at the bottom of an ocean, or along the edge of a tropical river or lake. By using the evidence preserved in the rocks, and by examining fossils, scientists can piece together the history of the Earth, its changing environmental conditions, and its changing life forms.

Given that most fossils are preserved in sediments from past environments that have been changed into rocky outcrops, understandably, most fossils are found in sedimentary rocks. The other major categories of rocks, igneous and metamorphic, are much less likely to preserve fossils; however, it is not impossible.

Igneous rocks are those that are related to volcanic activity, wherein the rock is formed by the cooling of magma or lava, or during a volcanic eruption. While those environments are not generally suitable for living things, there are on rare occasions fossils associated with igneous rocks. For example, an animal may be killed by lava, but the cooling rocks might preserve an impression of the animal as a mold. Such a mold is a fossil—evidence of past life. Entire herds of rhinos have been preserved under ash deposits resulting from distant volcanic eruptions (Voorhies 1985). The development of caves or fissures in these otherwise unfossiliferous rocks could produce extensive collections of fossils (for example, Andrews 1990).

Metamorphic rocks are those that have been changed by extremes of heat and pressure. Fossils that occur in the rocks prior to undergoing metamorphic change can be preserved as long as the metamorphism is low grade and not extreme enough to alter them beyond recognition. Such might be the case in a limestone with fossils that gets altered to a low grade metamorphic marble with fossils still visible.

Geologists have mapped the rocks exposed at the Earth's surface. Rocks that are similar in character, usually due to how they formed, are organized into mappable units called formations. Formations are formal units and are given names consisting generally of a place name and the word "formation," or the characteristic rock type. Examples include the Morrison Formation and the Aspen Shale. The place name is generally derived from the region in which the formation is first recognized.

Given that the environment in which a formation forms will strongly influence its likelihood of preserving fossils, and not all formations are equally likely to have fossils, the BLM uses a coding system to rank a formation's probability of containing significant fossils following IM 2008-009. This system is the Potential Fossil Yield Classification (PFYC) (Table 3-24, Map 2-7), a numerical ranking from 1 (low potential) to 5 (very high potential). The PFYC allows land managers to predict where significant fossils will occur in order to make informed planning decisions with regard to fossil resources.

In its practical application the PFYC is intended to help land managers plan where to focus resources during the planning or execution of ground-disturbing activities. The system can also be used by researchers in helping them to focus attention on fossil-bearing rock units, or perhaps more importantly, to highlight formations whose fossil potential is little known, pointing toward gaps in our paleontological knowledge.

Management plans used by the BLM to inform the actions of resource managers use the PFYC. So do consultants working for project proponents whose projects involve public land. The system can be used to inform the project proponents of areas of high likelihood for fossil resources so adequate planning can be done to mitigate the irreversible destruction of a valued heritage resources.

However, several important points should be kept in mind. Fossils are not evenly distributed throughout a formation, so even highly ranked formations may produce only occasional fossils in a given locality. Similarly, fossils can be found in unlikely places. For example, granite bedrock might be given the lowest potential rating but have a crevice or cave structure that is rich in fossils. Fossils have been found in basalt (Beck 1935; Chappell et al. 1951), a rock type that would be easy to discount as fossil bearing. Indeed, the discovery of a fossil in a class 1 rock unit might be all the more significant given its unexpected occurrence. The system is just designed to help in planning, and cannot replace detailed analysis on a case-by-case basis by trained personnel.

Users of the system most often rely on a geologic map of the area of interest. Areas of Montana/Dakotas have been mapped at various scales and to varying levels of precision. The PFYC is formation-based, but frequently, geologic maps show units that are lumped together for practical reasons. Those needing to implement the PFYC system should score the geologic units on maps with the highest PFYC rating given to the units separately. For example, when formations ranked 3 and 4 are mapped together, the entire combined unit should be considered as ranking a 4 for planning and mitigation purposes.

Sometimes rock units are not mapped by a formal formational unit, but are mapped based upon their geologic or lithologic character. Geologic and paleontological knowledge and experience is needed to apply the PFYC ranks to these units. A comprehensive list of PFYC ranks related to Montana and the Dakotas is maintained by the State Paleontologist.

Indicators

In addition to the predictive PFYC rank given to a rock unit, the number and concentration of paleontology localities in an area are other indicator of areas to be actively managed. In a broad context, the density of localities is an indicator of the richness of the paleontologic resources for an area. A high density of localities indicates that more active management of the paleontologic resource is warranted. A low density, however, may reflect either that fossils are rare or that the area has not received much exploration. A known locality in an area of rare occurrence may then be even more significant due to the rarity of the resource.

One significant area of BLM land within the FO area is the former Cycad National Monument in Fall River County. Fossil plants from the Early Cretaceous were found in abundance at this locality as early as 1890. These fossils created some excitement in the scientific community, and based upon their quality 320 acres of land were designated as a National Monument in 1922. However, over the years the fossils which were the justification for the creation of the monument were depleted from the area by casual and scientific collection. Eventually, enthusiasm for the monument and its development for the public waned, and the monument was deauthorized in 1957. A more complete history of the monument can be found in Santucci and Ghist (2014).

In 1982 highway crews working on the road through the area uncovered additional fossils, demonstrating that at least some fossils remained buried at the locality. Since the monument was deauthorized, the management of the land was returned to the BLM. On March 10, 1999, the former monument was designated as the Fossil Cycad ACEC.

Trends and Forecast

Scientific research is the primary use of the paleontological resource in the SDFO RMP planning area; casual collecting probably accounts for a lesser use. Researchers (non-casual use) are required to have a BLM Paleontological Resources Use Permit to collect fossils. Researchers are also required to file an annual report with the BLM that describes their research, lists the fossils collected, and includes a locality form for each location where fossils were collected. Fossils collected under a permit remain the property of the federal government and must be permanently curated in an approved repository.

Casual (hobby) collection of common invertebrate and plant fossils (petrified wood is managed separately) in reasonable quantities for personal, non-commercial use is allowed. Casual users are not required to report their collections. Consequently, the BLM has information on research efforts and can monitor the general use of the resource based on the filed reports, but has little information on the level or degree of use for hobby collecting.

The intensity of research is likely to remain constant, or perhaps increase. On average, the BLM issues a handful of survey, excavation, and consulting permits each year in the planning area. Recreational fossil collecting of common invertebrates and plants is allowed on most BLM land; however, some locations/areas may be closed to casual collection (for example, the Fossil Cycad National Monument ACEC). The number of people involved in casual collection is unknown. In addition, hikers, mountain bikers, and other outdoor enthusiasts sometimes accidentally discover fossil remains. Many important paleontological discoveries have been, and will continue to be, made by amateur or accidental paleontologists who report their finds to authorities.

The BLM is increasing its paleontological mitigation efforts which will result in more discoveries. These efforts may also result in finds in areas not previously surveyed as researchers tend to return to areas that are proven to have fossils. Much of this mitigation work will be performed by outside consultants who must be qualified paleontologists and have a valid Paleontological Resource Use Permit.

Fossil theft and vandalism is an issue within the planning area. Public interest in fossils and the commercial value of fossils have increased significantly in recent years. As public interest increases, the monetary value of fossils also rises; federal land managing agencies (including the BLM) are under increasing pressure to both protect scientifically significant fossil resources and to ensure their appropriate availability to the general public. Escalating commercial values of fossils also means that increasingly fossils on federal lands are subject to theft and vandalism. These crimes reduce scientific and public access to scientifically significant and instructive fossils and destroy the contextual information critical for interpreting the fossils.

As described in Title 43 CFR (Public Lands: Interior; Subparts 8365.1-5 and 8360.0-7), "willful disturbance, removal, and destruction of scientific resources or natural objects on federal lands is illegal and there are penalties for such violations." Often, the most pronounced damage is loss of the context and other significant scientific data, the worth of which is difficult to evaluate in monetary terms. With the passage of the PRPA (16 USC 470aaa, Sec. 6301), theft of paleontological resources now has separate codified penalties under federal law.

Table 3-24 Summary of the Potential Fossil Yield Classification (PFYC) System

Class	***Summary of Fossil Potential***
1	***Very Low*** –Igneous and metamorphic geologic units-not likely to contain recognizable fossils.
2	***Low*** – Sedimentary geologic units not likely to contain vertebrate fossils or scientifically significant non-vertebrate fossils.
3	***Moderate or Unknown*** – Fossiliferous sedimentary geologic units, content varies in significance, abundance, and predictable occurrence; or geologic units have not been investigated and their potential is unknown.
4	***High*** - Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability.
5	***Very High*** - Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils

Table 3-25 shows geological formations or units in the South Dakota Field Office area with a PFYC rank of 3-5, listed in approximate stratigraphic order from oldest at the bottom to youngest at the top. Fossils listed for each unit are generalized and were not necessarily found in the planning area.

Table 3-25
Geologic Formations/Units with PFYC Rank of 3-5
South Dakota Field Office Area

Formation	***Age***	***PFYC***	***Typical Fossils***
Java Formation	Quaternary	3	Fish, amphibians, reptiles, birds, and mammals
Lacustrine sediments, terrace deposits	Quaternary	3	Potential mammal megafauna
Outwash, gravel, and till	Quaternary	3	Potential mammal megafauna
Batesland Formation	Tertiary	4	Mammals and birds
Ogallala	Tertiary	3	Fauna and flora
Arikaree Group of South Dakota	Tertiary	5	Mammals, bird, and flora
White River Formation	Tertiary	5	Mammals
Cannonball Formation	Tertiary	5	Sharks, rays, fish, turtle, croc
Ludlow Formation	Tertiary	4	Mammals and flora
Tongue River Formation	Tertiary	4	Mammals and flora
Hell Creek Formation	Cretaceous	5	Dinosaurs, mammals, flora
Fox Hills Formation	Cretaceous	4	Pelecypods, sharks, amphibian, marine reptiles, flora
Pierre Shale	Cretaceous	4	Cephalopods, decapods, sharks, marine reptiles
Niobrara Formation	Cretaceous	3	Pelecypods, sharks, fish
Carlile Shale	Cretaceous	3	Cephalopods, marine reptile
Greenhorn Formation	Cretaceous	3	Pelecypods, fish
Belle Fourche Shale	Cretaceous	3	Pelecypods, shark, fish
Mowry Shale, Newcastle Sandstone, and Skull Creek Shale	Cretaceous	3	Cephalopods, marine reptile, flying reptile, fern
Inyan Kara Group, Fall River and Lakota	Cretaceous	5	Shark, dinosaur bones and tracks, flora
Morrison, Unkpapa, Sundance, and Gypsum Spring formations	Jurassic	5	Dinosaurs, marine reptiles,
Minnekahta Limestone and Opeche Shale	Pennsylvanian	3	Crinoids
Madison Group, Pahasapa Limestone, Deadwood, and Englewood Limestone	Mississippian	3	Crinoids, brachiopods
Whitewood Limestone, Winnipeg Formation	Ordovician	3	Cephelopods and corals
Deadwood Formation	Cambrian	3	Pelecypods and trilobites

Visual Resources

Visual resource management (VRM) was one of the issues identified during scoping as important to the SDFO RMP revision, as it is a requirement of planning regulations. Visual resource inventories were completed in 2008 and 2010. These inventories evaluated the visual features of land, water surface, vegetation, and structures across Butte, Fall River, Harding, Lawrence, Meade, Perkins and Pennington Counties. The inventories covered 250,243 acres or just over 91 percent of the BLM-administered surface land. The evaluations were then used to estimate inventory classes for similar BLM lands that are scattered parcels.

VRM classes are evaluated through the planning process and assigned in the RMP and may be different than inventory class. Protection of visual resources is frequently associated with recreational opportunities because the highest quality recreational experiences often depend on natural settings and scenic views. The assignment or designation of management class is based on management decisions considering consistency and multiple resource values. Future activities would affect the visual resource and be affected by the visual management class designation. An example of applying VRM considerations is provided in Figure 3-12.

Although every project and activity should be designed with visual resources on par with other resource considerations, VRM designations make it more likely that design techniques would be applied. These techniques include color or paint selection, earthwork, vegetative manipulation, structure design, reclamation/restoration, and linear alignments.

The visual resources of the BLM-managed public lands are typical of the Northern Great Plains and Black Hills. The rolling prairie vistas are occasionally interrupted by an isolated butte, farmstead, water drainage, fence line, road or overhead utility line. Light pollution at night is negligible, which is unusual nationwide. The minimal signing does little to indicate the transition between private land and scattered parcels of public land. In the Black Hills, BLM-administered portions of the Exemption Area exhibit a ponderosa pine-dominated ecosystem. Tree covered slopes have enticed private land development, increasing wildfire concerns and potential visual management conflicts. The scattered nature of BLM-administered lands increases the complexity of managing viewsheds across western South Dakota.

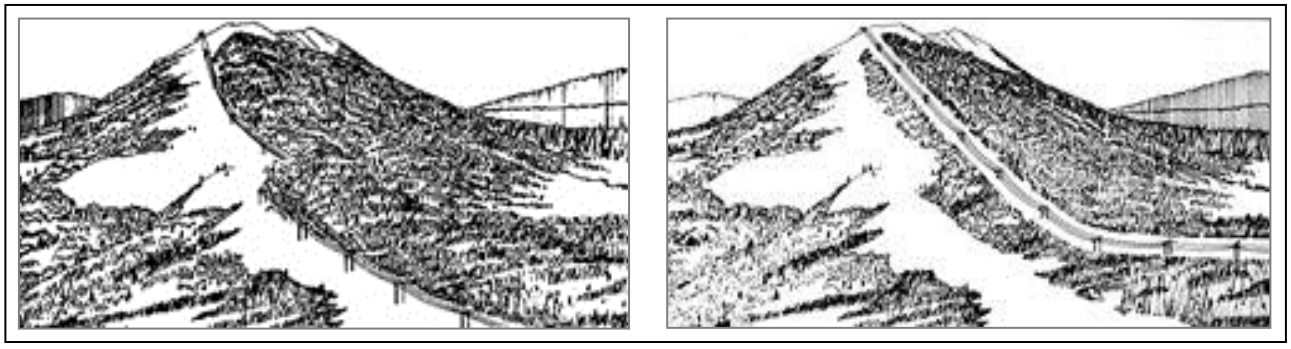


Figure 3-12
Example of Applying VRM Considerations

The picture on the left side of this figure shows a power line that was constructed to blend in with the terrain and vegetation using VRM considerations. The picture on the right side of Figure 3-12 shows an example of a power line that was constructed without VRM considerations. These pictures demonstrates that properly designed projects result in a more visually appealing landscape compared to projects that are designed and sited without visual resource impacts in mind.

Visual Resource Management Classes

The 1985 SDFO RMP did not assign VRM classes, and currently none have been assigned for 267,000 acres of the planning area. A visual resource inventory presented approximately 313 acres of Class I, 10,630 acres of Class II, 10,691 acres of Class III, and 252,535 acres of Class IV. The values of scenic quality, sensitivity level, and distance zones are evaluated together to arrive at the VRI class. The VRI class value ratings and acreages are displayed in Appendix F.

Subsequent amendments to the RMP designated VRM classes on approximately 6,700 acres as detailed below. BLM planning regulations require assigned VRM classes, and these classes would affect future activities in the planning area. VRM classes consist of four different management classes.

No Class I ratings are assigned to the planning area. This class preserves the existing character of the landscape. It provides for natural ecological changes; however, it does not preclude limited management activity. The level of change to the characteristic landscape should be very low and not attract attention. This class is appropriate for wilderness type settings.

Approximately 1,231 acres of BLM land are designated as Class II and include portions of the Fort Meade Recreation Area ACEC. This class retains the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

Approximately 4,992 acres of BLM land are designated as Class III. This includes portions of the Fort Meade Recreation Area ACEC. This class partially retains the existing character of the landscape. The level of change to the characteristic landscape could be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat basic elements found in predominant natural features of the characteristic landscape.

A total of 530 acres of BLM land designated as Class IV. This includes the Fossil Cycad ACEC and portions of the Fort Meade Recreation Area ACEC. The Fossil Cycad ACEC is bisected by State Highway 79 and grazing and off-road grazing administration activities are currently permitted. In the Fort Meade Recreation Area ACEC, Class IV is assigned to recreation development zones where management decided recreation facilities were appropriate. This class provides for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance and repeating the basic elements.

Indicators

When VRM class designations are complete "contrast ratings" can be used to indicate the levels of proposed visual changes to the characteristic landscape from any planned activities. Activities may have to be modified to keep the contrast ratings from exceeding VRM thresholds.

The scenic quality of the planning area has largely not changed since the 1988 RMP, and it will likely remain relatively unchanged because substantial changes in population or land uses are not predicted. No dramatic areawide alterations of the landscape have occurred, although isolated, sporadic private land development has occurred. The prevalence of grazing in the planning area, the open spaces afforded by an agricultural economy, and the minimal residential development has resulted in a continuation of visual features that have occurred for the past 50 years. However, large-scale energy development projects such as wind farms or uranium mine development have the potential to change this trend.

Fire Management and Ecology

Most, if not all of the ecological systems in the planning area have adapted to fire and other disturbances. Fire exclusion, vegetation management, and land uses in the 20th century altered many plant communities and fuel loadings. Stress from competition compounded by drought has left the area susceptible to insect and disease attacks. Because of these altered conditions, future fires have the potential to become larger, more intense, and more severe, especially in conifer fuel types. In addition, the introduction of non-native invasive plant species has increased the potential for negative impacts after fire, especially where annual grasses have invaded.

In the past decade, especially after the fire season in the year 2000 when the National Fire Plan was developed, the BLM and other agencies have increased vegetation treatments such as thinning and prescribed burning to reduce hazardous fuels in developed areas and to change plant community composition and structure for improved health and resiliency after fire.

Fire Management

The Fire/Fuels Management Plan for Montana and the Dakotas (BLM 2003) amended the 1985 South Dakota RMP to update direction for fire and fuels management. These amendments provided: (1) consistent fire management direction by assigning fire management categories and broad levels of treatment, (2) general guidance for fire management (both fire suppression and fuels management) needed to protect other resources values, and (3) revisions to RMP decisions that limited BLM's ability to conduct safe and efficient hazardous fuels treatments.

The BLM Fire Planning Manual, September 2012 (M-9211), Fire Planning Handbook, September 2012 (H-9211-1), and Chapter 09 of the Interagency Standards for Fire and Fire Aviation Operations summarize national fire policy, regulations, guidance, direction, and BLM fire planning policy. The 2009 Guidance for Implementation of Federal Wildland Fire Management Policy, provides revised direction for consistent implementation of the Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001). Key points of this policy and guidance are:

- Firefighter and public safety is the first priority in every fire management activity;
- Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives;
- Federal, state, tribal, local, interagency, and international coordination and cooperation are essential;
- Federal agencies and local communities collaborate, particularly when Community Wildfire Protection Plans (CWPPs) are prepared and implemented;
- The role of wildland fire as an ecological process and natural change agent will be incorporated into the planning process;
- Fire Management Plans (FMPs), programs, and activities support land and resource management plans and their implementation; and
- Fire regime condition class (FRCC) methodology will be utilized for project planning, prioritization, and monitoring.

The planning area crosses significant fire management borders, both geographical and organizational. The Eastern Montana/Dakotas District Office in Miles City provides suppression resources and management for BLM lands within Harding County in northwestern South Dakota, which is within the Northern Rockies Geographic Area. The remainder of the planning area is within the Rocky Mountain Geographic Area. The BLM Montana/Dakotas State Office has entered into a Memorandum of Understanding (MOU) with the states of South Dakota and Wyoming, Bureau of Indian Affairs (BIA), National Park Service (NPS), USFWS, and USFS. Under this MOU, the closest available fire suppression resources provide initial attack, regardless of jurisdiction. Outside of the Black Hills Forest Fire Protection District, local volunteer fire departments (VFD) provide direct fire suppression on BLM lands. Through an annual operating plan, the South Dakota Division of Wildland Fire (SDDWF) and its cooperators provide direct fire suppression on those BLM lands within the boundaries of the Black Hills Forest Fire Protection District.

Fires in the planning area are aggressively suppressed because of mixed ownership that includes woodlands, croplands, rangelands, and high values associated with wildland urban interface (WUI) or intermix. Most of the planning area is fuel model 1 or 2 (short grass), both of which have flashy fuels and high rates of spread.

The 2004 SDFO Fire Management Plan provides current direction for fire management activities. The plan divides the landscape into Fire Management Units (FMUs), where objectives, strategies, and constraints of the RMP can be described, as well as vegetation, fuel types, values at risk, WUI areas, and other characteristics. For each FMU, management recommendations are developed for the following fire management activities: wildfire suppression, prescribed fire and non-fire fuels treatments, emergency stabilization and rehabilitation (ESR), and community assistance/protection. Each FMU is also assigned a fire management category. The planning area includes three FMUs: Exemption Area, Fort Meade Recreation Area ACEC, and Remainder of South Dakota.

The Fire/Fuels Management Plan for Montana and the Dakotas (2003) amended the South Dakota RMP to adopt standard fire management categories, A through D as shown in Table 3-26 below. These categories range from Category A where fire (including prescribed fire) is not desired at all to Category D where fire is desired and there are no constraints on its use.

All FMUs identified in the planning area are designated as Category B, areas where fire may be desirable for resource benefit, but wildfire would cause negative impacts because of developments and sensitive resources. Suppression is required. Prescribed fire and mechanical treatments are used to protect communities, reduce hazardous fuels and to enhance resources.

Table 3-26
Comparison of Fire Management Categories

	Category A	***Category B***	***Category C***	***Category D***
Category Description	Fire is not desired at all.	Unplanned fire is likely to cause negative effects.	Fire is desired to manage ecosystems, but current vegetative condition creates constraints on use.	Fire is desired; no constraints on its use.
Fire Management Activities	Mitigation and suppression required. Fire should not be used to manage fuels.	Suppression required. Fire and non-fire fuels treatments may be used.	Suppression may be required. Fire and non-fire fuels treatments may be used.	Suppression may not be necessary. Both fire and non-fire treatments could be used.
Rationale for Categorization	Direct threats to life or property. Ecosystems not fire dependent. Long fire return intervals.	Unplanned ignitions would have negative effects on ecosystems unless mitigated.	Significant ecological, social, or political constraints.	Few ecological, social or political constraints. Less need for fuels treatments.
Fire Suppression Considerations	Emphasis on prevention, detection, and rapid suppression response and techniques.	Emphasis on prevention/education and suppression.	Emphasis on reducing unwanted ignitions, resource threats, and fuels accumulations.	Emphasis on using planned and unplanned wildfire to achieve resource objectives.

Source: Fire/Fuels Management Plan Environmental Assessment/Plan Amendment for Montana and the Dakotas. July 2003.

Wildfire Occurrence

Fire occurrence in the planning area generally extends from April through October, with the summer fire season occurring from late June through September. Most fires remain small because of initial attack suppression efforts, precipitation, or vegetation greenness. Fires that grow large usually result from a combination of high winds, cured vegetation, and/or fuel buildup. Drought conditions can exacerbate these conditions or contribute to early or extended fire seasons. Although uncertainty remains about the effects of climate change on fire occurrence, size, and severity, it seems accurate to assume warmer and drier conditions would likely create longer fire seasons.

Fire History

One hundred eight reported fires that burned approximately 32,776 BLM acres occurred between 1984 and 2014 (according to the SDFO Fire Management Plan and the Wildland Fire Management Information System database). Approximately 92 percent of those fires were naturally caused and eight percent were human caused. The majority of fires generally occurred between May and August. However, it must be noted that local fire departments (non-federal) may or may not report fires to the BLM, and local fire departments successfully and independently suppress an unknown number of fires every year, so the total number of fires during that period may be more. Table 3-27 summarizes the fire history from 1984 to 2014 by fire size class.

Table 3-27
Fire History by Fire Size Class – Planning Area 1984-2014

Fire Size Class							*Total Fires*	*Total Acres*
A (<0.2 acres)	*B (0.3-9 acres)*	*C (10-99 acres)*	*D (100-299 acres)*	*E (300-999 acres)*	*F (1000-4999 acres)*	*G (5000+ acres)*		
32	43	20	3	5	3	2	108	32,776

The most recent large wildfire in the area, the Grizzly Gulch Fire, occurred in June 2002 and burned approximately 11,500 acres. This fire caused the evacuation of the towns of Lead and Deadwood and either damaged or destroyed several homes. The cost to the community of Deadwood to shut down and evacuate the town during the height of summer tourist season was estimated to be around $2 million per day.

Historic and Pre-settlement Human Fire

Fire was a key disturbance process that shaped the composition and structure of plant and animal communities in western North America before widespread settlement by non-native peoples (Wright and Bailey 1982). A historical perspective on pre-settlement fire regimes is needed to understand the role that fires may have had in shaping plant community patterns and its relation to other ecosystem processes. Early explorers and fur trappers, without knowledge of whether the fires were natural or caused by Native Americans, often observed huge burned-over or cleared areas with many dead trees littering the landscape. Written accounts by early settlers remain incomplete, although many noted that there was evidence of burned or scorched trees and open prairies or savannas with tall grasses in every river basin. Comparisons of photographs from the late 1800s with recent photographs show dramatic increases in ponderosa pine densities and invasions into meadows in the Black Hills (Progulske 1974).

Fire Danger and Behavior

Three main factors affect fire behavior: fuels, weather, and topography. Each of these factors is variable within a geographical location. Of the three main factors, only fuel conditions can be managed or changed on the ground. The fuel matrix can be changed by a variety of treatments or methods to alter the structure, composition and/or density. These changes can affect the rates of spread and intensity of wildfires. The variability of fuel conditions across the planning area changes with aspect, slope, and forest/rangeland structure. Forest structure can be interpreted as three-dimensional patches of fuel, with differing amounts, size classes, arrangements, and flammability. Some fuels such as large tree boles are rarely consumed by fire, while others such as needle litter are partially to fully consumed in every fire. Other fuels such as leaves in the tree crowns are inconsequential in surface fires but are a major source of energy in crown fires. Forest structure affects fire behavior, and fire behavior in turn affects forest structure (Agee 1996).

Fire Ecology

Various adaptations allow vegetation to survive fire. Adaptations can facilitate survival of species or individuals (Kauffman 1990). Ponderosa pine is considered one of the most fire- resistant conifers in the West, and fire resistance increases as the tree matures (Miller 2000). Structurally, a tree such as ponderosa pine is fire resistant because it has thick bark (insulation)

Burning Index

Burning Index (BI) is often used as a fire danger indicator in areas where fine fuels such as grass are the main carrier of fire. Spring precipitation and green-up typically reduces BI to the lowest values of the year. As herbaceous vegetation matures and fuels dry in the summer, the BI values tend to steadily increase, and associated fire danger increases. BI is an index that rates fire danger related to potential flame length over a fire danger rating area.

Energy release component (ERC) is a cumulative measure for the fire season which provides a reflection of drought conditions and is used as a fire danger indicator in forested settings. ERC represents the release of heat per unit area in a flame zone and indicates potential fire intensity. Since this number represents the potential "heat release" per unit area in the flaming zone, it can provide guidance to several fire management activities. Typically, maximum ERC values are reached in late summer and decline only after significant precipitation events.

and few ladder fuels that would allow fire to move to the crown. Ponderosa pine has a deep rooting habitat. Although a surface fire may heat the soil and kill some surface roots, deeper roots remain intact and allow for continued uptake of water and nutrients. The long needles of ponderosa pine have high moisture content that surround terminal buds. Although needles may be scorched and killed by heat, they help protect meristematic tissue within the bud, allowing branch tips to refoliate (Miller 2000). Ponderosa pine is adapted to frequent fire that burns surface fuels and maintains an open understory. When fire is eliminated from this type of plant community, ladder fuels increase (such as thickets of small pine trees) and contribute to stand replacing crown fire and canopy mortality.

Meristem and Rhizome

Meristem is plant tissue whose cells actively divide to form new tissues that cause the plant to grow. The originally undifferentiated cells of the meristem can produce specialized cells to form the tissues of roots, leaves, and other plant parts.

A ***rhizome*** is a characteristically horizontal stem of a plant that is usually found underground, often sending out roots and shoots from its nodes. Rhizomes may also be referred to as creeping rootstalks, or rootstocks.

(SDSU Ag. Exp. Station. 1982. Plants of SD Grasslands.)

Plants with rhizomatous root systems, such as chokecherry, buffaloberry, and western wheatgrass will resprout vigorously after fire, even after fairly severe burns. The depth of the root system ranges from shallow to deep, so some roots and buds are protected from all but the most severe burns. Plants with root crowns or basal buds such as birch, aspen, and oak will resprout after fire, but the roots can be more susceptible to heat damage than rhizomatous roots. Many deciduous shrubs and herbaceous species are intolerant of partial or full shade and will become suppressed and decline in a forest understory if fire is eliminated from the plant community.

Grassland and shrubland areas within the prairie ecosystem are generally dry, and fire plays a key role in reducing conifer encroachment and recycling nutrients back into the soil. Historically, fires generally burned in a mosaic pattern and did not consume all of the vegetation on these sites. Fire favors prairie species in several ways. Burning clears accumulated litter, permitting dense growth. Fire produces dark ash that has a warming effect on the soil, giving the warm season prairie plants an advantage in the spring when there is more abundant moisture. Stimulated by fire, prairie species can outcompete non-prairie or invasive species (Schramm 1990). With 50 percent of their biomass below ground, prairie species recover with quick vegetative reproduction after a fire (Hays 1994).

Hazardous Fuels/Forest Management

To date, treatment efforts in the planning area have been focused in WUI areas within the Exemption Area and the Fort Meade Recreation Area ACEC. The most significant concern and constraint within these WUI areas is the amount and proximity of communities, homes, businesses, municipal buildings, and commercial developments. Forested stands in these areas consist of very dense, mid-aged stands of ponderosa pine. Due to fire exclusion and a lack of active forest management, these stands now have a dangerous susceptibility to wildfire. If it happens, a large crown fire could quickly outpace suppression capabilities and could result in another stand replacement fire event similar to the Grizzly Gulch Fire that occurred within the Exemption Area in 2002. (See the Forest and Woodland section for more discussion.)

Mechanical and prescribed fire treatments are being utilized to reduce risk to life, property, and natural resources; reduce fuel loads; achieve desired forest/rangeland health; improve wildlife habitat; control encroachment in meadow areas and deciduous draws; and encourage hardwood establishment. Limitations on all activities are identified for special management areas and use of ground-based harvest and slash-treating equipment.

From 2002 through 2014, the BLM SDFO treated 4,205 acres mechanically and 3,920 acres utilizing prescribed fire. The majority of mechanical treatments (2,985 acres) were focused near the communities of Lead and Deadwood within the Exemption Area. The rest of the mechanical treatments (1,220 acres) occurred within the Fort Meade Recreation Area adjacent to the community of Sturgis. All 3,920 acres of prescribed fire treatments occurred with the Fort Meade Recreation Area. Recent planning efforts have started to focus on areas within the prairie ecosystem that will utilize prescribed fire to meet multiple resource objectives.

In consideration of the WUI that surrounds these areas, a high priority has been placed on the Exemption Area and Fort Meade Recreation Area ACEC for fuels reduction work to continue. Additional mechanical and prescribed fire projects throughout the planning area are being planned to reduce the fuels and enhance the health of the forest and prairie ecosystems.

Nine counties (Butte, Custer, Fall River, Harding, Lawrence, Meade, Pennington, Perkins, and Stanley) in the planning area and one city (Lead) have developed CWPPs. The principal objective of these CWPPs is to reduce the risk from wildfire to life, property, critical infrastructure, and natural resources in the WUI areas. As directed by the Healthy Forests Restoration Act of 2003 (HFRA), these plans identify and prioritize areas for hazardous fuel reduction treatments. This legislation allows the BLM to work cooperatively with counties to consider the priorities of local communities as hazardous fuel reduction and forest management projects are being developed and implemented.

Fire Regimes

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention but includes the possible influence of aboriginal fire use (Agee 1993 and Brown 1995). When an ecological system or plant community does not burn at adapted intervals or severities, changes occur to the system which can affect species composition, vegetation characteristics, and fuel loading. These changes can further affect fire interval and burn severity, which further contribute to uncharacteristic changes in the plant community. These altered conditions within a plant community or system can be measured and classified according to the departure of that community relative to its natural or historic fire regime. The FRCC website summarizes the five fire regime groups (Hann et al. [http://www.frcc.gov] 2008), as shown in Table 3-28.

Table 3-28
Fire Regime Groups and Descriptions

Fire Regime Group	***Frequency of Fire***	***Severity of Fire***	***Severity Description***
I	0-35 years	Low / mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
III	35-200 years	Mixed / low	Generally mixed-severity; can also include low-severity fires.
IV	35-200 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
V	200+ years	Replacement / any severity	Generally replacement-severity; can include any severity type in this frequency range.

Source: Hann et al. [http://www.frcc.gov] 2008.

Fire Regime Condition Classes

FRCCs measure the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances such as insect and disease mortality, grazing, and drought. Possible causes of this departure include (but are not limited to) fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, and introduced insects and disease (Schmidt et al. 2002).

Condition classes measure vegetation and fire regime departure in terrestrial ecosystems. Condition Class 1 is within the natural range, Condition Class 2 is moderately altered from the natural range, and Condition Class 3 is significantly altered from the natural range of variation. Table 3-29 provides definitions of the three condition classes.

Table 3-29 Fire Regime Condition Class (FRCC) Characteristics	
Condition Class	***Description***
1	Less than 33% departure from the central tendency of the historical range of variation (HRV): Fire regimes are within the natural or historical range and risk of losing key ecosystem components is low. Vegetation attributes (composition and structure) are well intact and functioning.
2	33% to 66% departure: Fire regimes have been moderately altered. Risk of losing key ecosystem components is moderate. Fire frequencies may have departed by one or more return intervals (either increased or decreased). This departure may result in moderate changes in fire and vegetation attributes.
3	Greater than 66% departure: Fire regimes have been substantially altered. Risk of losing key ecosystem components is high. Fire frequencies may have departed by multiple return intervals. This may result in dramatic changes in fire size, fire intensity and severity, and landscape patterns. Vegetation attributes have been substantially altered.

Source: Hann et al. [www.frcc.gov] 2008

FRCC has been developed as an interagency, standardized process to assess and monitor fire regimes and the condition of vegetation communities relative to their fire regime. FRCC remains a measure of ecological departure used by the BLM to describe resource conditions. While this concept is most widely used in the fire, fuels, and forestry programs, it is also consistent with the concepts of land health.

Condition classes and fire regimes in the planning area have been analyzed at the landscape level utilizing the approved Interagency FRCC Guidebook methods (version 1.3.0, January 2008). The FRCC Software (Standard Landscape Worksheet Method) was utilized to complete FRCC assessments for both the Exemption Area and Fort Meade Recreation Area. The FRCC GIS Mapping Tool was utilized to complete assessments on BLM lands for the remainder of the planning area. In conjunction with other standard vegetation health assessments, FRCC assessments help establish reference conditions, identify current conditions, and direct attention to priority areas that would benefit from vegetation treatments such as fire. Reference condition characteristics have been identified and written descriptions developed for biophysical settings (BpS) across the U.S. Biophysical settings are used in FRCC to describe pre-settlement, disturbance-maintained vegetation communities, or reference conditions.

Current conditions may be similar to reference (Condition Class 1), moderately departed from reference (Condition Class 2), or highly departed from reference (Condition Class 3). Both the reference condition summary tables and the BpS description documents can be found on the FRCC website at http://www.frcc.gov. Tables 3-30, 3-31, and 3-32 summarize both the historic fire regime and current condition class by acres of vegetation within the planning area.

Table 3-30 Historic Fire Regime and Current Condition Class Exemption Area (approximately 5,250 acres of BLM land)					
Biophysical Setting	***Historic Fire Regime (I-V)***	***Condition Class 1 (acres)****	***Condition Class 2 (acres)*****	***Condition Class 3 (acres)******	***Total Acres***
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna-Savanna	I	1,554	776	1,555	3,885
Northwestern Great Plains Highland White Spruce Woodland	I	315	0	105	420
Rocky Mountain Aspen Forest and Woodland	IV	945	0	0	945
Total Acres by Condition Class (Exemption Area)	-	2,814	776	1,660	5,250

*Within the natural range
**Moderately altered from the natural range
***Significantly altered from the natural range of variation.

Table 3-31
Historic Fire Regime and Current Condition Class
Fort Meade Recreation Area (approximately 6,570 acres of BLM land)

Biophysical Setting	*Historic Fire Regime (I-V)*	*Condition Class 1 (acres)**	*Condition Class 2 (acres)***	*Condition Class 3 (acres)****	*Total Acres*
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna-Low Elevation Woodland	I	2,365	986	591	3,942
Northwestern Great Plains Mixed Grass Prairie	II	1,314	0	1,314	2,628
Total Acres by Condition Class (Fort Meade)		3,679	986	1,905	6,570

*Within the natural range
**Moderately altered from the natural range
***Significantly altered from the natural range of variation.

Table 3-32: Historic Fire Regime and Current Condition Class
Remainder of Planning Area (approximately 263,758 BLM acres)

Biophysical Setting	*Historic Fire Regime (I-V)*	*Condition Class 1 (acres)**	*Condition Class 2 (acres)***	*Condition Class 3 (acres)****	*Total Acres*
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	III	69	191	0	260
Inter-Mountain Basins Big Sagebrush Steppe	IV	1,879	28,273	661	30,813
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	III	5	4	83	92
Inter-Mountain Basins Greasewood Flat	V	1,094	0	212	1,306
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	IV	42	16	99	157
Northwestern Great Plains Highland White Spruce Woodland	I	152	139	0	291
Northwestern Great Plains Mixed Grass Prairie	II	123,891	31,355	32,356	187,602
Northwestern Great Plains Shrubland	II	41	12	4,936	4,989
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna-Savanna	I	1,001	85	2,114	3,200
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna-Low Elevation Woodland	I	2,550	464	3,426	6,440
Rocky Mountain Aspen Forest and Woodland	IV	73	70	0	143
Western Great Plains Floodplain Systems	III	277	770	2,668	3,715
Western Great Plains Sand Prairie	II	2,263	78	141	2,482
Western Great Plains Depressional Wetland Systems	IV	464	5	4	473
Western Great Plains Shortgrass Prairie	II	243	896	59	1,198
Western Great Plains Wooded Draw and Ravine	I	4,411	60	16,060	20,531
Rocky Mountain Subalpine-Montane Mesic Meadow	IV	0	0	66	66
Total Acres by Condition Class (Remainder of Planning Area)		138,455	62,418	62,885	263,758
Total Acres by Condition Class (Entire Planning Area (Tables 3-30, 3-31, and 3-32)		144,948	64,180	66,450	275,578

*Within the natural range
**Moderately altered from the natural range
***Significantly altered from the natural range of variation.

Ecological Interpretation of the Planning Area

Throughout the 20th century, fire was removed from ecosystems in the planning area for a multitude of reasons. Some of the reasons include: WUI development; scattered, intermingled parcels of public lands; adjacent private lands; grazing; and protection of culturally significant areas. Multiple fire cycles have been missed in the conifer, grassland, shrubland, and riparian strata, which has led to an abundance of pole-sized conifer (ponderosa pine) stands and loss of open canopied forests. It has also resulted in uncharacteristic regeneration patterns of dense, monotypic stands. In the grassland/ shrubland/riparian strata, the missed fire cycles have resulted in a loss of early seral communities. In addition, non-native species (e.g., smooth brome) have increased and represent communities not present historically.

Based upon likely management opportunities in the future, the desired conditions include continued ecological improvements in the different strata. This is reflected in moving Class 3 to 2, Class 2 to 1, and maintaining Class 1.

Management opportunities to maintain and improve current Condition Classes include:

Conifer Strata

- Restore fire regime through frequent prescribed fire.
- Maintain early seral (class A) communities.
- Reduce dense stands of Classes B and E through thinning and prescribed fire.
- Maintain abundance of open canopy classes (Class C and D) through thinning and prescribed fire.
- Maintain and/or improve desired mix of seral stages.
- Eliminate uncharacteristic seral stage through reducing regeneration pockets.

Vegetation in the conifer strata includes: ponderosa pine, spruce, aspen, and bur oak.

Grassland/Shrubland/Riparian Strata

- Restore fire regimes through frequent prescribed fire.
- Recruit early seral native community through native plant response and post-disturbance seeding opportunities, as appropriate.
- Increase native communities through post-disturbance seeding opportunities.
- Maintain and/or improve desired mix of seral stages.
- Reduce uncharacteristic class through disking, fire, grazing, or seeding treatments.

Vegetation in the different grassland, shrubland, and riparian strata includes:

- Grassland Strata (blue grama, buffalo grass, bluestem, prairie sandreed, switchgrass)
- Shrubland Strata (sagebrush, rabbitbrush, snowberry, chokecherry, skunkbrush, serviceberry, greasewood, shadscale, saltbrush, mahogany)
- Riparian Strata (cottonwood, willow, ash, wheatgrass, needle spikerush)

Burned Area Rehabilitation and Emergency Stabilization

Emergency stabilization and rehabilitation actions taken by the BLM follow the BLM's Burned Area Emergency Stabilization and Rehabilitation Handbook (H-1742-1, 2007), which outlines the process for implementing emergency fire stabilization projects following wildfires. Emergency stabilization and rehabilitation efforts in the planning area are undertaken on a case-by-case basis to protect and sustain ecosystems and public health and safety, and to help communities protect infrastructure. Burned areas are assessed to determine suitable and effective emergency stabilization and rehabilitation needs to meet current and anticipated environmental conditions. The BLM identifies actions such as stabilization, seeding, fencing, construction of water erosion abatement structures, and temporary closures, which could be taken to stabilize or rehabilitate burned areas. Rehabilitation and restoration activities are evaluated to assess the effectiveness of treatments.

Appropriate use of emergency fire rehabilitation funds includes implementing the following practices to:

- Protect life, property, soil, water, and vegetation resources;
- Prevent unacceptable onsite or offsite damage;
- Facilitate meeting land use plan goals and other federal laws; and
- Reduce the invasion and establishment of undesirable or invasive vegetation.

Emergency fire rehabilitation funds are not used for rehabilitation of wildfire suppression efforts (suppression damage); this includes rehabilitating firelines, helispots, and fire camps. Costs for rehabilitating wildfire suppression efforts are funded by a specific wildfire project code.

Wilderness Characteristics

The BLM maintains an inventory , including wilderness characteristics, of all lands under its jurisdiction, pursuant to Section 201 of the Federal Land Policy and Management Act of 1976 (FLPMA). Also, consistent with FLPMA and other applicable authorities, the BLM will consider the wilderness characteristics of BLM land when undertaking its multiple-use land use planning. Lands with Wilderness Characteristics are generally defined as contiguous BLM-administered lands of 5,000 acres or more (or smaller areas contiguous with lands designated for wilderness protection), mostly natural, and containing outstanding opportunities for solitude or primitive and unconfined recreation. The existing inventory of BLM land in the South Dakota planning area was updated and evaluated to determine whether any lands have wilderness characteristics. The inventory update was completed under guidance contained in Instruction Memorandum 2011-154.

Four parcels within the South Dakota Field Office had enough contiguous acreage to meet the size requirement and were analyzed further. The four parcels were consolidated into three areas as described below. The parcels were all determined to not possess wilderness characteristics.

Areas 1 and 2 – Center of the Nation Area. Consisting of two parcels (parcel A, 49,775 acres, and parcel B, 7,306 acres), the BLM land is checkerboarded by numerous private land inholdings. Cell phone towers, roads and trails, pasture fences, stock dams and tanks and stockwater pipelines are common. Oil and gas compressor stations and gas pipelines are also present. Ranch and farm headquarters are present on adjacent private land and contain primary dwellings, outbuildings, livestock shelters, shelterbelts and farm equipment. BLM land is within 1.5 miles of private land. The areas do not possess wilderness characteristics.

Area 3 – Newell Area. BLM-administered surface includes approximately 9,400 acres and forms a long, narrow parcel, averaging .75 miles wide. No location is greater than one mile from the private land boundary. Roads that are popular with hunters during deer season bisect the parcel. Stock tanks and fences necessary for the current grazing use are found throughout the area. Ranch and farm headquarters are common adjacent to public land. The area lacks primitive character and outstanding opportunities for solitude or a primitive and unconfined type of recreation. The area does not possess wilderness characteristics.

Area 4 – Fort Meade Recreation Area ACEC. The 6,574 acre area has roaded natural characteristics, including an interstate highway that cuts through a portion of the area, a state highway that bisects the parcel, a gravel two lane designated Back Country Byway, a developed campground, a picnic ground, and a horse campground. The city of Sturgis is the neighbor to the west, and developments such as the Sturgis High School, Fort Meade Veterans Hospital, and the Full Throttle Saloon are adjacent on the east side. The area does not possess wilderness characteristics.

Cave and Karst Resources

Karsts (underground caves formed by water) are likely present in the planning area, but little information is known about the location and size of karsts in BLM-administered public lands.

The central and western Black Hills contain limestone strata with good karst and cave features such as the Jewel and Wind Cave National Monuments. However, the BLM-administered surface lands are located beyond the extent of these strata, and very little potential exists for caves or karst topography of any significance.

A few isolated parcels of BLM-administered land occur in Fall River County within a few miles of known cave areas (Jewel Cave National Monument). These tracts are located in the Red Valley that form a circle around the Black Hills. The Triassic Red Beds and the Cretaceous Minnekahta limestone occur at the surface in this area, which are cave-bearing geologic strata.

The Pahasapa limestone is the principal cave-bearing geologic strata in the Black Hills, and this strata does not generally occur on any BLM-administered land in the Black Hills.

Wild Horses and Burros

No BLM herd management areas or BLM managed herds of wild horses or burros occur within the planning area.

Resource Uses

This section describes the current resource uses that occur on BLM-administered lands. Historical uses are also discussed when such discussion is needed to provide a context for understanding current resource uses.

Forest and Woodland Products

All of the planning area, except for the Fossil Cycad ACEC, is available for forest and woodland product sale. Excess material may be sold, but the purpose of the treatments must be for wildlife habitat and to reduce fire risk rather than for a sustainable product objective.

Resource Condition and Capabilities Evaluation

From 2004 through 2009, the SDFO averaged approximately 7,500 tons annually of forest and woodland product use. Units of measure vary by product and include 110 acres of commercial timber sales for about 800 tons/year, approximately 300 tons/year in personal saw timber and special forest product sales, and approximately 6,400 tons/year in stewardship projects on approximately 400 acres/year. The majority of wood products are obtained from ponderosa pine. The volume contributed is negligible compared to the amount cut from the Black Hills National Forest; however, the revenue generated on the open market brings fair value back to the taxpayer, makes vegetation projects more economically feasible, and provides local employment.

Most of the timber sales for the planning area have occurred around Deadwood and Lead in the Exemption Area and around Sturgis on the Fort Meade Recreation Area ACEC. These are the most likely commercial product areas due to the species (ponderosa pine) and size of trees available. Commercial projects have specific objectives to reduce hazardous fuels and improve wildlife habitat. Restrictions on snag cutting, large tree retention, and turkey roost maintenance are applied to retain some old growth characteristics. On occasion, a small amount of bur oak or juniper is sold for firewood or fence posts. Forestry BMPs (Appendix B) are followed during harvesting to reduce impacts to soil and water quality.

Personal use permits are sold for incidental forest product removal. The products utilized in the past include fuelwood (averaging 10 permits per year), saw timber (averaging 2 permits per year), Christmas trees (averaging 3 permits per year), and post and poles (averaging 1 permit per year). These permits are assumed to continue at the current rate per year and occur in the woodland as well as forested areas. Firewood gathering is considered both a recreational and economic benefit to residents.

The Mountain Pine Beetle epidemic on the neighboring Black Hills National Forest is still continuing. Stand susceptibility on BLM land will deteriorate without management due to increasing stand densities. Climate change may also increase stress on trees, increasing susceptibility to Mountain Pine Beetle attack. Funding treatments is often uncertain. Retaining the option of selling excess products makes treatment more likely. The SDFO has recognized the value of combining overstory and understory treatments with stewardship contracts and has made a concerted effort to use this contracting method.

Successful fire suppression in the past has led to fire regimes that are unnatural. Private property and cities are growing in these altered fire regimes, and prescribed burning without prior treatment carries increased risk. Again, allowing commercial treatments make management more likely to occur due to economics.

The availability of a continuing commercial market was in doubt in 2009; however, it appears that the lumber market in the area may be stabilizing.

Livestock Grazing

The BLM is responsible for administering livestock grazing on BLM-owned surface acres in the planning area, with the majority of grazing authorizations occurring throughout western South Dakota and two in Brule County in eastern South Dakota. Livestock grazing includes the grazing of domestic animals (e.g., cattle, sheep, horses, goats, and bison). BLM lands are important to local ranch operations, particularly in the western half of the planning area (west of the Missouri River). In Butte and Harding counties, a large number of ranch operations lease or are permitted to graze on some BLM lands, while other counties vary considerably in the number of ranch operations that utilize BLM grazing leases in their operations.

BLM lands in the planning area are almost always intermingled with private and state lands, which are grazed as one unit. In many cases, the BLM land amounts to a small percentage of the total land grazed within a ranch. As mentioned above, exceptions include several BLM allotments in Butte and Harding counties which contain larger blocks of public land (see discussion below for an explanation of grazing allotments). The Moreau Grazing Association grazes livestock on 20,000 acres of public land in Butte and Harding counties and the Howes Grazing Association grazes livestock on 5,000 acres of public land in Meade County. These associations own private land and lease state lands for grazing with the BLM grazing allotments. Motorized wheeled cross-country travel is allowed to maintain or repair range improvements, treat or move livestock, spray weeds, monitor animal and range conditions, and complete other management tasks directly associated with livestock and range management.

BLM lands maintain the integrity of many ranch operations and support the culture, lifestyle, and livelihood of the grazing lessees. In many cases, grazing lessees are heavily dependent on forage from public lands. Because of the co-mingled nature of land ownership, decisions made regarding public land often have a major impact on grazing lessees who own land adjacent to public land. In the eastern portion of the planning area, BLM lands usually consist of small, isolated tracts and the viability of most grazing operations is not as dependent on public land. The exception is a small portion of public land in northeastern Stanley County in the central part of the state.

Most of the grazing that occurs in the planning area occurs on open, rolling plains or river breaks. Grazing also occurs in pine forests in and around the Black Hills. The Fort Meade Recreational Area is unique because a contract bid system for grazing privileges is used, a system that was in place when the BLM acquired this land from the Department of Veterans Affairs in the 1950s. Since this land was acquired after the passage of the Taylor Grazing Act of 1934, this type of management can be continued per 43 CFR 4110.1-1.

Portions of the Exemption Area near Lead and Deadwood (see the Transportation and Facilities section for a detailed description of this area) are permitted for grazing use, however many tracts are not allotted. Grazing in the Black Hills can be difficult to manage as livestock tend to congregate on creek bottoms and overuse or trample riparian areas. Within the southern Black Hills, grazing occurs in a mixture of pine and juniper woodlands or on open grassland where this portion of the planning area has received the greatest impact from drought.

Resource Condition and Capabilities Evaluation

Changes in federal grazing regulations required the BLM to evaluate rangeland health and manage domestic livestock in accordance with the Montana/Dakotas Standards for Rangeland Health and Guidelines for Livestock Grazing Management (Appendix A). The five standards (upland, riparian, water quality, air quality, and habitat biodiversity) relate primarily to physical and biological features of the landscape and are intended to be within the control of the land manager and achievable by the user. These standards relate to all BLM resource programs, and rangeland health can be positively or adversely impacted by any resource program or resource use.

According to BLM rangeland health assessments completed since 2004, approximately 20,900 acres of the 260,000 acres assessed within the planning area did not meet Standards for Rangeland Health (BLM 2010b). There were approximately 4,500 acres not meeting the Standards for Rangeland Health as a result of livestock grazing with the remaining 16,400 acres not meeting standards due to causes other than livestock grazing. The presence of non-native species is a common contributor to standards not being met for causes other than livestock grazing. Corrective management actions have been implemented on all grazing allotments that did not meet the standards due to livestock grazing. Reassessment of some of the allotments not meeting standards indicates that 3,100 acres have improved and now meet the standards, leaving 1,400 acres still not meeting standards due to livestock grazing. Additional monitoring will be conducted on these allotments to ensure significant progress toward meeting the standards.

Grazing Allotments

A grazing allotment is "a designated grazing unit that contains one or more pastures." The BLM issues grazing leases to authorize grazing use on allotments. These leases contain terms and conditions specifying the term of the lease, details about grazing use, and conditions of the lease. Normally, an allotment will have one grazing lease, but occasionally two or more leases may be issued for one allotment. In addition, one lessee may have more than one grazing allotment.

Grazing allotments are administered under three selective management categories – Improve, Maintain, and Custodial – and are designed to prioritize allotments with the most significant resource conflicts and the greatest potential for improvement.

Use of the allotment categorization to prioritize work subsided when Standards were implemented in 1997. BLM Instruction Memorandum No. 2009-018 has revived the use of the allotment categorization, directing offices to use it to prioritize the work associated with processing and issuing grazing authorizations. The criteria to assign allotment categorization has evolved to ensure land health considerations are the primary basis for prioritizing the processing of grazing permits and leases and for monitoring the effectiveness of grazing management. The SDFO has and will continue to review allotment categories to determine an allotment's appropriate category.

Improve (I) category allotments are lands with significant resource values that have concerns or conflicts. Management intensity is highest on these allotments. In most cases, "I" category allotments contain large blocks of public land. These lands have higher management opportunities and values than other allotments. A specific season of use and grazing rotation is established on these allotments.

Maintain (M) category allotments contain lands in satisfactory condition that have significant resource values. These allotments are managed to maintain current resource conditions and are actively managed to ensure that resource values do not decline. A specific season of use and grazing rotation is established on these allotments.

Custodial (C) category allotments are lower priority and contain tracts of public land surrounded by private land. Most "C" category allotments are small, isolated tracts of public land with few resource issues or conflicts. Management opportunities on these lands are limited because of the land tenure pattern. All "C" category allotments are managed as part of the overall ranch operation as long as range and riparian conditions remain healthy.

Of the 504 allotments in the planning area, 21 are in "I" category, 55 are in the "M" category, and 428 are in the "C" category. (See Map 2-8 [Map packet], Allotment Map, for BLM-administered grazing allotments in the western two-thirds of South Dakota.) The number of acres in allotments by category are approximately 37,200 acres in I category allotments, 125,850 acres in M category allotments, and 106,850 acres in C category allotments.

The Standards are used to enhance sustainable livestock grazing and wildlife habitat while protecting watersheds and riparian ecosystems. For allotments that do not meet the Standards, guidelines designed to improve rangeland health are specified in allotment management plans or as terms and conditions in grazing permits/leases. Current management strives to maintain or improve rangeland health on all grazing allotments; however, the emphasis is on "I" and "M" category allotments and not all allotments in the planning area.

Where livestock grazing has been identified as contributing to an allotment failing to meet the Standards or guidelines, changes to management have been or will be implemented. Monitoring is conducted to determine whether objectives are being met and if further adjustments in management need to be made.

Animal Unit Month Allocations

As mentioned above, the BLM currently has 504 grazing allotments within the planning area, with cattle the most common type of livestock. Of the 504 grazing allotments, 423 are for cattle, 27 for sheep, 42 sheep and cattle, 9 bison, and 3 horse allotments. A few of the allotments may have horses along with other livestock types and three of the bison allotments have cattle in addition to bison. The SDFO also manages four grazing leases in Carter County, Montana, and one lease in Crook County, Wyoming, because the lessee's main operation is in South Dakota. However, the grazing lease and allotment numbers covered in this RMP only include BLM lands in South Dakota.

A total of 73,800 Animal Unit Months (AUMs) are permitted on about 271,000 acres of BLM land in South Dakota. Permitted use levels are allocated at approximately 25 percent of the available annual forage production for livestock and 75 percent of the annual forage production to meet wildlife and watershed needs. The SDFO bases forage allocation on Missouri River Basin surveys from the 1950s and 1960s which state that field inventory of the public domain and related lands established recommended stocking rates as shown within the river basin reports. The reports that cover western South Dakota include the Little Missouri, Grand River, Moreau River, Lower Cheyenne River, Belle Fourche River, Upper Cheyenne River, Bad River and a portion of the White River basin.

BLM considers an AUM as the forage needed to support one 1,000 pound cow, one cow/calf pair, one horse, or five sheep for one month (approximately 800 pounds of forage). An example of livestock allocation for the typical continuous grazed rangeland is as follows:

1,000 lb / ac X .25 (harvest efficiency) = 250 lb forage consumed out of the 1,000 pounds produced
250 lb forage consumed / 800 lb (forage for 1 animal unit for 1 month) = 0.313 AUMs / ac or 3.2 ac / AUM.

Approximately 25 percent of the annual production is trampled or soiled by livestock and would be available to meet wildlife forage/cover requirements and watershed needs.

Cattle larger or smaller than 1,000 pounds can be given an incremental increase or decrease in the animal unit equivalent (AUE). An example would be that a 1,300 pound cow with calf would consume 1.3 AUMs of forage in a month, where a 900 pound cow with calf would consume 0.9 AUMs. These numbers would be used in determining forage allocation during the planning process of an AMP. BLM does not bill for livestock grazing based on the AUE, and therefore bills 1 AUM as one cow/calf pair, yearling, horse, bison, or 5 sheep.

Grazing systems used on BLM lands fall into the following categories: year long, season long, and rotational (i.e., deferred rotation, rest rotation, and time-controlled grazing systems). Of the 504 allotments in the planning area, approximately 47 percent (239) authorize year-long use, which is a reflection of the intermingled land pattern across the planning area, as well as the small percentage of BLM land found in those allotments. A large number of these ranch operations use pastures containing BLM land throughout the year; however, this does not mean individual pastures containing BLM lands are used 12 months of the year. Allotments with large tracts of private land that are intermingled with small tracts of public land are often permitted as year-round leases to allow flexibility in the overall ranch operation.

Rangeland improvement projects can serve as vegetation management tools or BMPs to control or improve livestock distribution and use within an allotment. These projects consist primarily of fences, reservoirs, springs, water wells, and vegetative or land treatments. When properly implemented, rangeland improvement projects assist in maintaining or improving rangeland health and increasing forage production.

Permitted use levels have remained relatively static since the last RMP was written in the 1980s. Actual use of allotments has been down since 2000 as a result of a statewide drought. The primary factor behind reduced livestock use has been inadequate reservoir water, and a secondary factor has been reduced forage production. Permitted use levels have slowly begun to rebound in the last couple of years where precipitation has returned to normal. Some numbers may still be down due to livestock losses from large storms in the spring of 2009.

Funding for drought assistance programs has increased for water developments. Development projects include wells and stock water pipelines on rangelands. A majority of these developments occurs on private land but occasionally extend onto public land. Other agencies such as the NRCS and the Farm Service Agency (FSA) work with livestock producers to implement developments. Proposals for developments are usually approved for development on BLM-administered public lands if the proposal is consistent with BLM goals. The end result of the drought assistance programs is a higher number of watering sites throughout the planning area. This impact is normally beneficial, but care has to be taken to ensure that projects are implemented as part of a larger strategy to improve management and resource conditions.

Within the planning area, BLM staff has observed and documented an increase in cheatgrass (*Bromus tectorum* and *Bromus japonicus*) during drought periods and a decrease in cheatgrass following drought periods (2004 -2010 SDFO rangeland health assessments).

Trends

Ranching has traditionally provided a multi-generational livelihood, but this tradition has changed. In many cases, family ranches are sold or leased when the estate of the parents is settled, rather than being operated by the next generation. Recently, ranch land sales for recreational purposes, primarily for hunting, have also increased. This trend often results in ranches being broken into smaller units. The new owners often lease the ranch (including BLM-administered public lands) for grazing and use it for recreation.

In many cases, the recreational value of property has become more important than agricultural values, especially on lands with scenic qualities. A related trend is the use of the internet to market and advertise land, a marketing niche that is raising awareness of available recreational ranch property in the planning area. The trend of increased recreational land sales is likely to fluctuate with the economy and its relative stability in the western U.S.

Ranching and Climate Change

Another trend relates to the concern over global climate change and how it relates to livestock grazing and management of rangelands.

Livestock produce methane gas which has been linked to global climate change. Methane is a potent gas that contributes to global warming (http://www.epa.gov/climatechange/emissions/index.html). According to the NRCS, animal operations can influence GHG levels in a variety of ways, including:

Biological organisms (including animals) emit carbon dioxide and methane naturally. Ruminants, such as cattle and sheep, produce more intestinal methane than non-ruminants.

The breakdown or decomposition of biological materials such as manure, feed, or mortalities can produce carbon dioxide (as a natural byproduct of the breakdown/decomposition process), methane (under anaerobic conditions), and nitrous oxides (mainly from the nitrification/denitrification processes).

Combustion in on-farm equipment or the burning of biological material also produces carbon dioxide as a natural byproduct (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/climatechange/). High levels of carbon dioxide in the atmosphere are believed to contribute to global warming. Sequestering of carbon by maintaining or improving the conditions of rangeland is considered a beneficial practice to reduce carbon dioxide levels in the atmosphere (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/climatechange/).

Recent research in the northern Great Plains indicates net reductions of greenhouse gas emissions on native range pastures can be most effectively achieved through moderate stocking rates (Liebeg et al. 2010). This research underscored the value of moderately grazed native rangeland in the northern Great Plains to serve as a net CO_2 sink, especially in comparison to heavily grazed pastures.

Livestock grazing may be affected if summer temperatures rise significantly and create drier conditions where pasture yields decline and livestock tend to gain less weight (USEPA 1998). An increase in the vulnerability to pests, invasive species and a loss of native species is likely to occur through a combination of climate change and human-induced stresses (Karl et al. 2009). Adaptation to changing conditions through adaptive management practices would provide the best means to reduce adverse impacts to grazing.

Increasing carbon sequestration on farms and ranches is likely to continue to be a focal point of farm and ranch incentive programs. While the incentive programs mostly focus on private lands, BLM-administered lands are affected indirectly as many pastures contain a mixture of public and private land.

Recreation

Outdoor recreation opportunities, facilities, and services play an important role in the state's economy, health, and well-being. Recreation is a component of many activities in South Dakota and is a significant element of the overall quality of life for residents. Surveys show that the most popular outdoor recreation activities for South Dakota residents are walking, watching wildlife, hiking, biking, swimming, picnicking, nature photography, fishing, motorcycling, hunting, camping, golfing, horseback riding, and boating (SDGFP 2003).

Recreation opportunities in the planning area, particularly on larger BLM tracts, meet a wide diversity of visitor preferences. Participation in specific recreational activities on public land varies with the season of the year. Hunting dominates the scene in the fall, with snowmobiling, cross-country skiing, and ice fishing occurring sporadically during the winter. Springtime activities include fishing, horseback riding, sightseeing, and photography. Driving for pleasure, sightseeing, camping, picnicking, fishing, and hiking dominate recreation during the summer.

During the Sturgis Rally each August, western South Dakota experiences a heavy influx of non-resident motorcycle riders. Their numbers help make driving for pleasure the largest recreation activity in the planning area. Although visitor use information is lacking or incomplete for some areas, the BLM public lands in the RMP area received approximately 9,175 recreation visits in 2011 (BLM Recreation Management Information System [RMIS]).

The range of recreational experiences, opportunities, and settings available on a given area of land is classified through the Recreation Setting Characteristics (RSC) system (see Table 3-33 and Appendices L and M for a detailed description of this system). The public perceives recreation as more than just camping, fishing, and hiking. People choose a specific setting for each recreational activity in order to realize a desired set of experiences. For example, hiking on a natural-surfaced trail in a remote setting with few facilities may offer some visitors a sense of solitude, challenge, and self-reliance. In contrast, a hard-surfaced, interpretive loop trail in an area with facilities and amenities may offer more comfort, security, and social opportunities for other visitors.

Table 3-33
VRM and RSC Classes

VRM Class	*RSC Class*
I	Primitive
II	Back Country
III or IV	Middle Country
III or IV	Front Country

Maintaining a spectrum of RSC classes is very important to provide people with choices. The RSC classifications or guidelines were not established under the 1985 RMP because they had not yet been developed. The current opportunities and experiences available for areas outside the Fort Meade Recreational Area are consistent with the semi-primitive

motorized class for the physical (remoteness, naturalness, and facilities), social (contacts, group size, and evidence of use), and operational (mechanized use, management controls, and visitor services) components. The establishment or designation of RSC classes should be consistent with the VRM classes and subsequent travel planning to help define and direct the setting of an area.

Refer to Appendices L and M for more details about RSC classes.

Recreation Management Areas

BLM lands designated for recreation management in the SDFO are classified into one of two Recreation Management Area categories – Special Recreation Management Areas (SRMAs) or Extensive Recreation Management Areas (ERMAs). The third designation possibility is Public Lands Not Designated as a Recreation Management Area, which the SDFO did not use due to the recognition of recreation values on multiple use lands.

Special Recreation Management Areas

SRMAs have recreational values with development potential or concerns. These areas need more intensive recreation management because outdoor recreation is a high priority, thus requiring a greater recreation investment. Major investments in facilities within SRMAs can be excluded where the BLM's strategy is to focus on experiences and recreational outcomes to the visiting public. However, major investments in visitor services can be authorized both to sustain those distinctive setting characteristics and to maintain visitor freedom so they can choose where to go and what to do.

Special Recreation Management Area (SRMA)

A SRMA is an area where recreation is one of the principal management objectives, where intensive recreation management is needed, and where more than minimal recreation-related investments are required.

The planning area presently has no SRMAs. Although the Fort Meade Recreation Area ACEC has been called a recreation area, no land management decision has designated it as a SRMA. The Fort Meade area is adjacent to Sturgis, South Dakota.

Fort Meade Recreation Area

Approximately 7,000 acres were established in 1878 as the Fort Meade Military Reserve, although jurisdiction was transferred to the Department of Veterans Affairs in 1944. In 1954 and 1955, 3,200 acres of the 7,000 acre total were transferred to the BLM. In 1960, Public Land Order (PLO) 2112 transferred an additional 3,200 acres to the BLM. In addition, this order withdrew the acreage from appropriation, including the mining laws, and dedicated the land for the "conservation of natural resources, including recreation and wildlife resources and protection of wildlife habitat." Approximately 6,574 acres are now included in the Fort Meade Recreation Area (FMRA) parcel. Grazing leases are let on a highest bidder basis (see the Livestock Grazing section).

The FMRA was then designated as an ACEC under the 1996 RMP Amendment to protect historic/cultural resources and associated landscape (BLM 1996). The major investments in recreation facilities, visitor assistance, and interpretation were in keeping with an SRMA and were funded through the recreation program, although a formal designation has not been made. The ACEC designation at the FMRA is still the most critical for protection of the historic/cultural resources, and the management of the recreation resources is conducted to complement that designation.

Motorized travel in the FMRA is limited to designated roads and authorized use. The Fort Meade Backcountry Byway bisects the south half of the FMRA.

The 1996 RMP Amendment established objectives and appropriate uses for the FMRA ACEC (BLM 1996). Recreation development zones are identified by the BLM as areas where higher levels of recreation use occur. These areas often contain hiking trails, picnic grounds, campsites, and other developments associated with recreational use. The developed recreation sites in the FMRA ACEC include Alkali Creek Horse Camp, Alkali Creek Recreation Site and Trailhead, Fort Meade Trailhead, and Fort Meade Reservoir (Figure 2-2). Of these sites, Alkali Creek Horse Camp and Alkali Creek Recreation Site are the only two fee collection areas. Vandalism is fairly minor, but persistent. A few stock water

reservoirs offer trout and bass fishing, and some reservoirs have northern pike. Winter provides opportunities for ice fishing. Access to most recreation facilities and areas is by the primary highways and gravel roads that are compatible with two-wheel drive vehicles.

Extensive Recreation Management Areas and Public Lands Not Designated as a Recreation Management Area

Any BLM land in the SDFO not delineated as a SRMA is designated as an ERMA. This designation applies to approximately 270,000 acres of BLM lands in the planning area managed for traditional dispersed recreational use with less facility development. No BLM land is designated Public Lands Not Designated as a Recreation Management Area.

The ERMA includes the Exemption Area (exempted from the Black Hills National Forest designation), an island of mixed ownership, uses, and conditions inside, but different than, the Black Hills National Forest, Figure 2-3. The BLM's recreation influence in this area is small due to the scattered nature of its tracts, but potentially important for accessing other public lands. Within the Exemption Area are the "Twin Cities" of Deadwood and Lead, the former Homestake Gold Mine now being refurbished for reuse as an underground laboratory, the terminus and five miles of the 113-mile Mickleson Trail, Terry Peak and Mystic Miner ski hills, trailheads and portions of the South Dakota Snowmobile Trail system, as well as numerous other features.

As noted previously, the Fort Meade Recreation Area ACEC is managed as an SRMA, with its own management plan to protect and enhance cultural and historic characteristics with other resource activity potential, even though the area has not been previously formally designated an SRMA. Past funding for protection and interpretation has come through the recreation program.

Special Recreation Permits

The BLM issues Special Recreation Permits (SRPs) for specific recreational uses of BLM land and related waters. Permits are a means to manage visitor use, protect natural and cultural resources, and serve as a mechanism to accommodate commercial recreational uses. Five types of use require permits: commercial, competitive, vending, organized groups/events, and individual or group use in special areas. Most SRPs in the planning area are issued for commercial events at Fort Meade, and no permit denial due to overlapping requests has ever happened. An average of five SRPs are issued annually (two outfitter/guide and three special events); they are evaluated on a first-come, first-serve basis.

Lands and Realty

The BLM lands and realty program is a support program which responds to the demands of industry and utilities, the public, other government entities, and other BLM disciplines to help ensure BLM lands are managed to provide the greatest possible public benefit. The program is responsible for management of land tenure adjustments, land use authorizations, withdrawals, trespass identification and abatement, and public access. The most active part of the lands and realty program is the authorization of rights-of-way (ROWs) that are issued primarily for roads, utilities, and oil and gas facilities.

Split Estate

Split estate is a land status term which applies when the surface is patented or deeded into private ownership, while the federal government retains the mineral rights.

Reverse split estate applies when the federal government transferred both the surface and mineral estate into private ownership, but the surface estate was subsequently returned, while the minerals, or a portion of them, were retained by the private landowner.

(BLM 2008d Fact Sheet)

The SDFO administers a total of 274,345 acres of public land surface estate and 1,715,677 acres of subsurface (mineral) estate. A majority of the surface estate is within Brule, Butte, Custer, Fall River, Haakon, Harding, Lawrence, Meade, Pennington, Perkins, and Stanley counties. Many surface acres are scattered and/or isolated tracts. Larger acreage of subsurface estate exists than surface because some homestead acts reserved the mineral estate to the federal government; the federal minerals that underlie the private surface are called split-estate. The land ownership pattern of BLM surface estate in South Dakota is largely a result of those less desirable areas being left over from the homesteading days of the late 1800s and early 1900s.

Four American Indian reservations – Pine Ridge, Rosebud, Cheyenne River, and a portion of the Standing Rock Reservation – are located west of the Missouri River within the planning area. The reservations are considered sovereign nations, and therefore, the BLM has no jurisdiction on their lands.

Land Tenure

Land tenure (or land ownership) adjustment refers to those actions that result in the disposal of BLM lands and/or the acquisition of non-federal lands or interests.

The 1985 South Dakota RMP identified lands by area which may meet FLPMA criteria as having the potential for disposal. Over the long term, lands may also be considered for exchanges or jurisdictional transfers and sales. The remaining lands identified as having a potential for community expansion may be disposed of on a case-by-case basis under the Recreation and Public Purposes Act (R&PP) of 1954, which authorizes the transfer of BLM lands when it serves the public interest.

Planning guidance regarding land ownership is provided by the South Dakota RMP (1986), as amended. This direction established land exchange as the preferred method of land tenure adjustment and also established retention, disposal, and acquisition criteria to be used in categorizing BLM lands.

The 1986 RMP stated that the fragmented ownership pattern of public land presents numerous management problems for the SDFO and often restricts public use. Adjusting land patterns, preferably by exchange, could increase the BLM's management efficiency in certain situations and provide legal access to isolated tracts. The RMP further stated that access is one of the considerations in exchanges, and easements are considered where exchanges cannot be utilized to resolve conflicts. The land exchanges are based on willing parties, and the goal of the lands program is to consolidate the scattered public lands to increase management efficiency and accessibility.

Disposal

BLM-administered lands are found to be suitable for disposal if such lands, due to their location or other characteristics, are difficult and uneconomic to manage as part of the public lands. These lands can be disposed of by any method, including exchange, and are not suitable for management by another federal agency or department. Such lands were often acquired for a specific purpose and the lands are no longer required for that or any other federal purpose. Disposal serves important public objectives that outweigh other public objectives and values served by maintaining such lands in federal ownership.

Disposal of BLM lands usually takes place through exchange or sale. Disposals result in a title transfer, wherein the lands leave the public domain. All disposal actions are coordinated with adjoining landowners, local governments, and current land users. Disposals through sale and use of sale receipts must meet the guidance and specifications provided by FLPMA (43 CFR 2710), and other acts.

More than 80,000 acres in the planning area (approximately 29 percent of the BLM-administered surface acres) were identified in the 1985 RMP as having potential for disposal if they met all the criteria identified in that plan. The disposal tracts in the 1985 RMP included all BLM-administered public lands in Map 2-12 that are outside of the retention zone except for the BLM-administered public lands in Pennington County that are located south of the Cheyenne River.

Land Exchange

Land exchanges are an important to bring lands and associated interests with high public resource values into public ownership; consolidate land ownership and mineral estate patterns to achieve more efficient management of resources and BLM programs; and dispose of public land parcels identified through the land use planning process.

Land exchange has been the primary means of land ownership adjustment within the planning area. Since the RMP was completed in 1985, two land exchanges affecting federal and/or non-federal lands within the planning area have occurred. These exchanges have improved public land ownership patterns by generally disposing of 210 small, isolated tracts of public land with limited resource values while acquiring more than 1,725 acres of non-federal land with higher public resource values adjacent to larger blocks of BLM land (BLM LR 2000 database).

Sales

The objective of BLM land sales is to provide a means of disposal of public lands identified through the land use planning process.

The BLM's general authority to sell public lands is Section 203 of FLPMA. However, the agency does not offer much land for sale, as FLPMA requires that public lands be retained in public ownership unless as a result of land use planning, disposal of certain parcels is warranted. Also, tracts of land designated as potentially available for disposal in BLM land use plans are more likely to be conveyed out of federal ownership through an exchange rather than a sale. Public lands must be sold at no less than fair market value and meet FLPMA's specific sale criteria.

The SDFO sold public land under Section 203 of FLPMA between 1985 and 2011. The SDFO has used the exchange process as much as possible to convey tracts of public land that have been identified for disposal.

Within the planning area, it is anticipated that more land will be transferred from public to private ownership. This assumption is based on the need to continue consolidating lands for more efficient management, the continuation of exchanges, and other land tenure actions (disposal based on public demand).

Other Disposal Methods

Under the Act of June 14, 1926 (as amended, 1954, commonly known as the Recreation and Public Purposes Act [R&PP]; mentioned in above sections), the BLM, at its discretion, can sell or lease public lands for recreational or public purposes to state and local governments and to qualified nonprofit organizations. Examples of typical uses under the Act are historic monument sites, campgrounds, schools, city and county parks, fire houses, and hospitals. The BLM will not approve a lease or conveyance made under this act unless the public lands involved are used for an established or definitely proposed project. The lessee or patentee must commit to a plan of physical development, management, and use as well as certain other requirements before a lease or patent is issued.

No R&PP Act patents have been issued in the planning area since the 1985 RMP was completed.

Since the completion of the 1986 RMP, no lands have been conveyed for agricultural entries under the Desert Land Act of 1877 or the Carey Act of 1894, nor have any lands been conveyed for airport or railroad grants, Indian allotments, or color of title actions. The Color-of-Title Act (1970) provides that any individual, group, or corporation who has evidence giving the appearance of having title to public lands, which are administered by the BLM, and legal title to the lands remains vested in the U.S., may file a color-of-title claim. An applicant will receive a patent conveying clear title to the lands upon payment of the fair and reasonable sale price that reflects current market value of the lands if they meet the requirements for a Class 1 or Class 2 claim (http://www.blm.gov/pgdata/etc/medialib/blm/es/state_office.Par.2730.File.dat/Color-of-Title%20Fact%20Sheet.pdf).

Jurisdictional transfers between agencies may be desirable, and may be authorized by Congress, when such an action provides for efficiencies, or furthers a specific goal of an agency, or Congress.

Across the U.S., under Ordinances of 1785 and 1850, land grants made by statehood acts allowed schools to receive sections 16 and 36 of each township; these grants came into effect on the date of acceptance or approval of the survey of each state. The state was entitled to select unappropriated public lands other than sections 16 and 36 to fulfill the obligation if, on the date the grant would have gone into effect, sections 16 or 36 were appropriated under some applicable land laws or if there were natural deficiencies caused by fractional townships or sections and the grant could not be made.

Land Exchange

Land exchange involves trading lands or interests in lands with willing non-federal landowners. Public lands may be exchanged by the BLM for lands owned by corporations, individuals, states, local governments, or other legal entities legally capable of holding title to and conveying land. Exchanges are voluntary or discretionary BLM transactions with willing landowners that serve as a viable tool for the BLM to accomplish its goals and mission, except for those exchanges that are congressionally mandated or judicially required. The value of the lands to be exchanged must be approximately equal and the lands must be located within the same state. Exchanges must be in the public's interest and in conformance with the applicable land use plan. (http://www.blm.gov/wo/st/en/prog/more/lands/land_tenure/exchange.html).

BLM lands within the SDFO were patented to the State of South Dakota in 1985 to satisfy state indemnity selections. As of 2009, no state indemnity selection obligations remain for the State of South Dakota; therefore, the federal government's commitment has been met.

Acquisitions

Acquisition of land or interest in land occurs through purchase, exchange, or donation when the subject land meets acquisition criteria identified in land use planning. Under the Land and Water Conservation Fund Act of 1965 (LWCF) (16 USC 460) the BLM focuses land purchases within units of the National Landscape Conservation System or within special planning designations (such as SRMA or ACEC). Acquisitions can include fee title transfers or less than fee easements (access or conservation) wherein the BLM acquires interests in land, allowing the BLM to control certain rights on private property such as access or development. Land acquisition depends on many factors, especially willing sellers.

Land and Water Conservation Fund

The LWCF Act was created by Congress in 1965. The Land and Water Conservation Fund (LWCF) was a bipartisan commitment to safeguard natural areas, water resources and our cultural heritage, and to provide recreation opportunities to all Americans. It was a simple idea: use revenues from the depletion of one natural resource – offshore oil and gas – to support the conservation of another precious resource – our land and water. (http://www.lwcfcoalition.org/about-lwcf.html)

The BLM has authority under FLPMA to purchase lands or interests in lands. Although purchase is not as widely used as exchange to acquire fee title to non-federal lands, the agency does occasionally purchase non-federal lands to acquire key natural resources or legal ownership to lands that enhance management of existing public lands and resources.

Acquiring land (fee title) through purchase helps consolidate management areas to strengthen resource protection and is used primarily to enhance recreation opportunities and acquire critical wildlife habitat. Purchase can also be used as a means of acquisition where the owner of the non-federal land is not interested in exchanging lands and is seeking monetary compensation.

The SDFO completed no fee purchases between late 1985 and 2010.

Acquiring interests in land (less than fee title) through the purchase of easements allows the BLM to control certain rights on private property which usually involve access or development. Acquiring conservation easements allows the landowner to maintain certain land uses but protects the land from uses incompatible with the purpose of the conservation easement. Acquiring access easements across non-federal lands for roads and trails provides the BLM and the public with necessary access to "landlocked" public acres and allows for federal maintenance of the roads or trails.

As of 2010, the SDFO has not acquired any conservation easements, does not administer any acres of conservation easement, and administers only three access easements on non-federal lands. (The purchase of road easements and the reservation of access rights in land disposal cases are the primary means of securing and maintaining access to public lands.)

The BLM also occasionally receives gifts (donations) of land or interests in land where an entity elects not to receive the market value for the interests being conveyed. However, the SDFO has had no fee donations between the time the RMP was finalized in 1985 and 2010.

To summarize, between 1985 and 2010 the SDFO has not completed any fee purchases, has not acquired any conservation easements or administered any conservation easement acres, and has not had any land donations or fee donations. The SDFO administers only three access easements on non-federal lands.

Land Use Authorizations

Land use authorizations include:

- ROW grants under Title V of FLPMA, and ROW grants and associated temporary use permits under the Mineral Leasing Act of 1920, as amended;
- leases, permits, and easements under Section 302 of FLPMA; and
- R&PP Act leases.

Land use authorizations are issued for a variety of purposes. Examples of long-term uses include ROWs for linear and site facilities. A permit is issued for a short term (up to three years) and allows the temporary use of BLM lands for such things as agricultural purposes, filming, placement of beehives, etc. which involve minimal land improvement or disturbance. Permits can be renewed, but are also revocable. The SDFO analyzes requests for land use authorizations and applies mitigation measures on a case-by-case basis.

Right-of-Way Grants

The majority of ROWs granted are authorized by FLPMA or the Mineral Leasing Act. FLPMA ROWs authorize the use of BLM land for access to private land for utility facilities and infrastructure, or for communication facilities. The Mineral Leasing Act authorizes ROWs for oil and gas facilities not authorized under an oil and gas lease.

Exceptions to the need for a ROW under FLPMA or the Mineral Leasing Act include roads and/or facilities authorized by specific statute such as Federal Aid Highways, county roads authorized under Revised Statute 2477 before implementation of FLPMA, and casual use activities that do not cause any appreciable surface disturbance.

The Revised Statute 2477 designation applies to constructed public roads over non-reserved public lands. County governments, not individuals, administer these roads. There was no requirement for an executed document authorizing these roads, nor were they required to be officially recorded on the BLM's land use plats. These roads continue to be recognized as authorized ROWs since implementation of FLPMA, but over the last several years efforts have been made to have these roads documented. It is a controversial issue that remains unresolved at this time.

Right-of-Way Grants

A ROW grant authorizes the use of a specific area of BLM land for a specific facility and a specific period of time; however, it grants no authority or possessory interest to the holder. A few examples of facilities typically requiring a ROW include highways, electrical transmission and distribution lines, canals, railroads, pipelines, and communication sites. Exceptions to the need for a ROW are transportation and utility facilities that are otherwise authorized by statute, regulation, or a BLM-approved land use authorization. In addition, casual use activities involving practices that do not ordinarily cause any appreciable disturbance to BLM lands, resources, or improvements typically do not require a ROW.

The ROW program is becoming more active in the SDFO in terms of the number of cases processed. According to the BLM's LR 2000 database, the SDFO currently administers 172 existing ROW grants for a myriad of different facilities which are held by private individuals as well as various business and government entities. These ROWs are for roads, electric transmission/distribution lines, and telephone lines. An estimated six to ten ROW actions are processed annually by the SDFO, including applications for ROWs for new facilities, as well as the amendment, assignment, renewal, or relinquishment of existing ROWs.

Issuance of right-of-way grants is a large component of the lands and realty program due to demand from the public, industry, utility companies, and local or state governments. Within the SDFO, there is a growing demand for ROWs for roads and utilities to subdivisions and individual home sites in the Exemption Area and other areas in and near the Black Hills. Based on increasing energy and communication demands in the area, it is anticipated that there may be an increase in public lands allocated for utility corridor purposes. Demands also continue on public lands near already existing communities. Anticipated demands for oil and gas and wind energy could increase applications for ROWs and corridors to accommodate this development.

As mentioned in the Special Status Species section, the greater sage-grouse is a BLM-sensitive species and a state species of concern. One of the primary ROW concerns within the planning area is removal of nesting and brood-rearing cover for greater sage-grouse by developing corridors for predators to travel and roosts for raptors. Management of this issue is a high priority for the BLM lands and realty program, and proper management of BLM surface lands is important for recreation, wildlife, erosion control, riparian areas, and water quality.

The 1985 RMP did not designate any areas as communication sites. Presently there is little interest in communication sites on public lands within the planning area because most of areas with good topography and line of sight to population areas were previously determined and authorized as needed. The planning area has no communication site authorizations.

Rights-of-Way – Utility and Transportation Corridors

Beginning in the mid-1970s, conservation organizations, federal agencies, and the utility industry recognized the need to establish a regional corridor system in the western United States. In 1976, FLPMA introduced the concept of corridor designation and recognition of transportation and utility corridors. ROW regulations under FLPMA define designated ROW corridors and transportation and utility corridors as follows:

Designated ROW Corridor: A parcel of land (either linear or area in character) that has been identified by law, by Secretarial Order, through the land use planning process, or by other management decision as being a preferred location for existing and future ROW grants and suitable to accommodate more than one type of ROW or one or more ROWs which are similar, identical, or compatible.

Transportation and Utility Corridor: A parcel of land without fixed limits or boundaries that is being used as the location for one or more transportation or utility ROWs to develop a corridor system and focus attention on future ROW needs.

Specific to the planning area, the Fort Meade Recreation Plan Amendment states, "The establishment of designated utility corridors will restrict the placement of transmission and distribution facilities" (BLM 1996, p. 18. See Figure 2-2, Firearm Restriction and Utility Corridors, for current corridors on Fort Meade Recreation Area ACEC.)

Demands for utility and pipeline corridors could increase with the recent emphasis on energy development nationwide, with some interest for additional oil and gas pipelines and future wind energy projects occurring in the planning area. The planning area has had no activity regarding solar energy projects, but this could change in the future. Proposals to place solar energy facilities on BLM-administered lands would be processed under lands and realty right-of-way regulations and guidance. Refer to the Renewable Energy section of this chapter for additional discussion about Renewable Energy.

Leases, Permits, and Easements

Section 302 of FLPMA gives the BLM authority to issue, at its discretion, leases, permits, and easements for the use, occupancy, and development of public lands. Any use not specifically authorized under other laws or regulations and not specifically forbidden by law may be authorized under this section of FLPMA. The objective of this section of FLPMA is to provide for the use of public lands by the private sector, state, and local governments where the uses conform to land use plans and cannot be achieved prudently or feasibly on land other than public lands.

Uses which may be authorized under Section 302 include residential, agricultural, industrial, commercial, and uses that cannot be authorized under the primary ROW authorities. Some specific examples of uses authorized under this authority include commercial filming, equipment storage sites, and ski resorts. However, currently no Section 302 FLPMA leases, permits, or easements are administered by the SDFO. Section 507 of FLPMA is the only authority for land use authorizations for other federal agencies.

Public lands can also be leased for public airport purposes under the Federal Public Airport Act of 1928. This authority has not been widely used in the BLM, and the SDFO does not currently administer any such leases.

Even though no leases, permits, or easements are presently administered in the SDFO, the potential need for this type of authorization may occur and may increase as BLM continues to have more urban interface with the small and irregular parcels of public lands.

Recreation and Public Purposes Leases

Under the Act of June 14, 1926 (as amended, 1954, commonly known as the Recreation and Public Purposes Act [R&PP]; mentioned in above sections), the BLM, at its discretion, can sell or lease public lands for recreational or public purposes to

state and local governments and to qualified nonprofit organizations. Examples of typical uses under the Act are historic monument sites, campgrounds, schools, city and county parks, fire houses, and hospitals. The BLM will not approve a lease or conveyance made under this act unless the public lands involved are used for an established or definitely proposed project. The lessee or patentee must commit to a plan of physical development, management, and use as well as certain other requirements before a lease or patent is issued.

The BLM periodically reviews areas leased or conveyed under the Act to assure continued compliance with the terms. A lease may be terminated, or patented land may revert to the U.S. if the entity involved is not complying with the terms.

The BLM currently administers four R&PP leases in the planning area for picnic areas and target ranges for rifles and muzzleloaders.

Withdrawals

A withdrawal is a formal action that sets aside, withholds, or reserves federal lands by statute or administrative order for public purposes. Withdrawals are established for a wide range of public purposes, including military reservations, administrative sites, national parks, reclamation projects, recreation sites, and power site reserves. The three major types of formal withdrawals are congressional, administrative, and withdrawals under the Federal Power Act of June 10, 1920:

Congressional withdrawals are legislative withdrawals in the form of public laws; examples include designations for wild and scenic rivers and national parks.

Administrative withdrawals are made by the President, Secretary of the Interior, or other officers of the executive branch of the federal government; examples include recreation sites and public water reserves.

Withdrawals under the Federal Power Act of June 10, 1920 are power project withdrawals automatically created by filing an application for hydroelectric power development with the Federal Energy Regulatory Commission (FERC).

As part of its administrative withdrawal responsibility, the BLM reviews all proposed administrative withdrawals and revocations, recommends pertinent ones to the Assistant Secretary of the Interior for Land and Minerals Management, develops and conducts a withdrawal review program, and assists other bureaus and agencies with their withdrawal and revocation programs.

The SDFO has established only two formal withdrawals within the planning area: the Fort Meade Recreation Area ACEC, and the Fossil Cycad ACEC; however, the SDFO has the potential of recommending one new administrative withdrawal action for a portion of Bear Butte.

Land Classification

A classification is the designation of public land as being valuable or suitable for a specific purpose, use, or resource. Some land classifications segregate public lands from the operation of all or some of the public land laws and/or mineral laws so they can be disposed of or leased, but others identify lands suitable for retention under multiple use management. All state selections in South Dakota have been satisfied.

Section 7 of the Taylor Grazing Act (1934) is now the only existing land classification authority for BLM. Before the passage of FLPMA in 1976, all BLM land disposal or lease actions required classification. Since FLPMA, Section 7 classifications are required only for the following disposal/lease authorities outside Alaska: the R&PP Act of 1954, state selections, the Desert Land Act of 1877 (DLA), the Carey Act of 1894, and the Indian General Allotment Act (IGAA) of 1887.

Section 7 classifications of the Taylor Grazing Act, including those made before FLPMA was enacted, remain in full force and effect until modified or terminated. Also, classifications made under now-repealed authorities such as the Small Tracts Act of 1938 and the Classification and Multiple Use Act (C&MU) of 1964 continue in full force and effect until they are modified or terminated.

No applications or requests for R&PP leases or patents are currently pending in the planning area. Since 1985, no activity has been associated with the DLA or IGAA in the planning area.

Trespass Identification and Abatement

Trespass under the lands and realty program can be split into three separate categories: unauthorized use, unauthorized occupancy, and unauthorized development.

Unauthorized Use refers to activities that do not appreciably alter the physical character of BLM land or vegetative resources. Some examples of unauthorized use include the abandonment of property or trash, enclosures, and use of existing roads and trails for purposes which require a use fee or ROW.

Unauthorized Occupancy refers to activities which result in full or part-time human occupancy or use. An example would be the construction, placement, occupancy, or assertion of ownership of a facility or structure (cabin, house, natural shelter, or trailer) on BLM-administered land.

Unauthorized Development means an activity that physically alters the character of BLM-administered land or vegetative resources. Examples include cultivation of the land and road or trail construction/realignment.

It is the responsibility of the BLM to protect the public's best interest regarding its managed lands. Trespass actions are public land uses that occur or are ongoing without specific authorization or that exceeds the established thresholds of an authorization or casual use. Trespass actions can cause unmitigated damage to public lands and natural resources, and the cost to resolve trespass and to clean up and reclaim the public land impacted by trespass is often passed on to the general public. These costs direct appropriated funds away from planned work and impact the BLM's ability to complete its mission. In addition, the fair market value for use of the public lands is not realized by the public.

Trespass resolution involves cessation of the unauthorized use and may require removing the unauthorized facilities, appropriate authorization of that use or disposal by sale. Three considerations are included in trespass abatement:

(1) Payment of the administrative costs to resolve the trespass,
(2) Payment of fair market value for the period of unauthorized use, and
(3) Rehabilitation and restoration of the affected public lands.

Some of the types of illegal activities regarding trespass within the planning area include: illegally placing portions of buildings, especially in the Exemption Area; indiscriminate dumping of trash, debris, and household wastes; farming and/or irrigating public land; constructing roads; and building other utility-related features. The most common types of illegal activities in the planning area are placing portions of buildings in unauthorized areas, building roads and utility-related features, along with some farming and trash dumping.

Public Access

For the purposes of this section, access refers to the physical ability and legal right of the public, agency personnel, and authorized users to reach BLM lands. The BLM lands and realty program primarily assists in acquisition of perpetual, exclusive easements to provide for legal access at the location where other programs have identified a need. Public access easements are pursued as opportunities arise and/or when access is critical, are acquired in perpetuity, and are usually exclusive, which means the BLM controls use of the road. When the BLM acquires a perpetual, exclusive easement for public road access, any commercial use of the road by industry or utilities requires an approved ROW grant from the BLM.

Within BLM lands as a whole, access to BLM-administered land is an issue of concern for both agency personnel and the public. The fragmented ownership pattern of BLM land intermingled with private and state land complicates the access issue. Little progress has been made to reduce the lack of legal and physical access to BLM-administered land. Access acquisition efforts will continue to focus on larger blocks of public lands which are designated for retention in public ownership; areas with important resource values; areas where public demand for access is high; and areas with substantial BLM investments.

Access will be acquired from willing landowners on a case-by-case basis as opportunities arise, using criteria and direction provided in the guidance referred to above. Reciprocal ROWs will be used as a tool to obtain public access to public lands when the opportunity arises.

The acquisition of road easements is the primary means of obtaining legal access to BLM land. Exclusive easements provide public access, while nonexclusive easements are generally for administrative use. Since the completion of the South Dakota RMP in 1985, the SDFO has acquired one access-related easement in the Exemption Area.

Land exchanges are used on occasion to acquire needed access to BLM land, and the consolidation of BLM land ownership patterns by exchange has generally improved access in the planning area. When disposing of federal parcels containing roads or trails necessary for access to other BLM lands, the SDFO has protected two of these access routes by reserving to the USA the right to access in the patent documents.

Minerals

This section is divided into three categories of mineral resources reflecting the legal divisions under which BLM manages them—leasable, locatable, and salable.

Leasable minerals include oil, gas, coalbed natural gas, coal (including lignite), and geothermal resources. Presently, no coalbed natural gas production occurs in the planning area, nor are there any ongoing exploration activities. However, approximately 75 coalbed natural gas wells are projected to be drilled during the next 20 years. Currently, no interest has been expressed in mining lignite within the planning area. It is anticipated that this trend will continue into the future.

Locatable minerals include metallic minerals such as gold, silver, copper, etc.; energy metals such as uranium and thorium, bentonite, and cement grade limestone. Demand for bentonite has been slowly growing. It is anticipated that future demand for this commodity will be cyclic, due to changing levels of oil and gas drilling. There is current interest in in-situ leach uranium mining in the planning area; therefore, uranium exploration activities are anticipated in the future. Mining high quality limestone for cement production is expected to occur in the future.

Bentonite: An absorbent aluminum silicate clay formed from volcanic ash and used in various adhesives, cements, and ceramic fillers.

Stratigraphy: The study of rock strata, with emphasis on the distribution, deposition, and age of sedimentary rocks. (http://www.geology.com)

Salable minerals include sand, gravel, limestone aggregate, clay/dirt fill, and decorative rock.

Generally, the categories lend themselves to straightforward classification of minerals. However, due to legislation, individual minerals under certain conditions, definitions, and land status may fit under different categories.

Planning Area

The planning area is composed primarily of large portions of the Williston Basin but includes very small portions of the Powder River Basin, as well as small to moderate portions of other basins and uplifts. The Reasonably Foreseeable Development (RFD) "Study Area" (see the Minerals Ownership section below for discussion) is the western half of the planning area (see Figure 3-13).

Geological, Topographical, and Mineralogical Setting

The great majority of the planning area is underlain by sedimentary rocks. A large portion of the middle of the North American continent had been submerged under shallow seas and swamps many times for hundreds of millions of years, resulting in thousands of feet of sediment, including shale, sandstone, limestone, dolomite, bentonite, coal, and other sedimentary rocks. Large quantities of lignite coal are found in the northern part of the planning area, and two very small deposits of bituminous coal in the southwest part of the planning area.

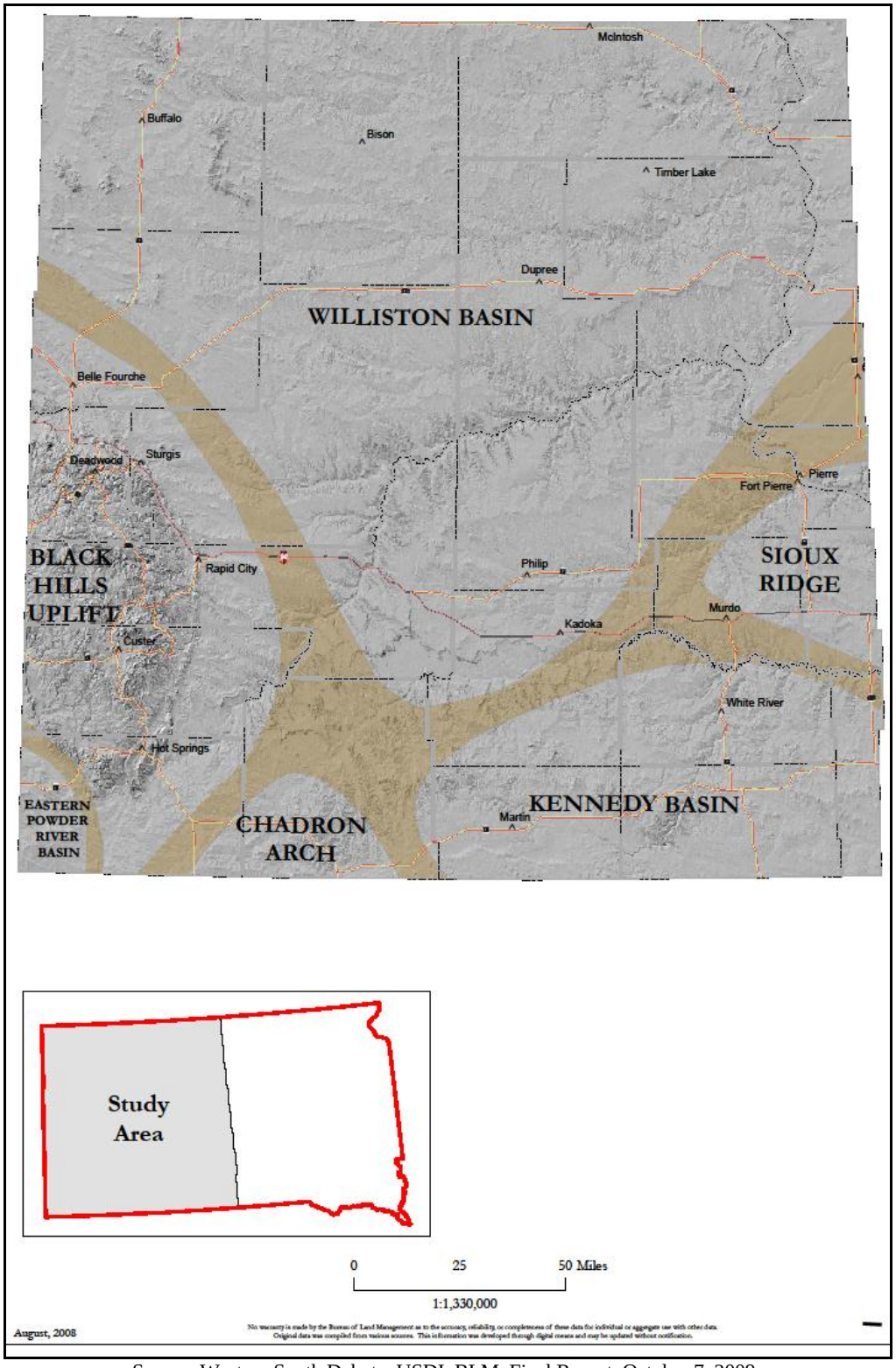
Millions of years ago, numerous volcanic eruptions, mostly hundreds of miles away from the planning area, resulted in multiple accumulations of volcanic ash in marine environments, which developed into highly expansive bentonite clay. Some of the volcanic ash deposits also contributed uranium, further concentrated by geologic processes. Oil and natural gas are also contained in some of the sedimentary formations in the northwest and southwest portions of the planning area. These stratigraphic units have been mildly folded and faulted over most of the planning area.

Approximately 65 million years ago, the Black Hills uplift greatly changed the character and complexity of a significant area of western South Dakota. This uplift included several uplifts and erosion cycles, particularly with a great number and volume of igneous intrusions during the last uplift, which contributed most of its metallic minerals and pegmatite (a coarse-grained igneous rock, sometimes rich in rare elements such as uranium and tungsten) mineral materials. The uplift and subsequent erosion exposed many formations which are deeply buried in the rest of the planning area (see Figure 3-14, Stratigraphic Chart of the South Dakota Study Area).

The planning area contains only minimal quantities of glacial materials, although glacial action north and east of the planning area during the last glacial epoch, ending about 10,000 years ago, greatly changed the character of the area containing nearly all of the federal lands. This indirect change occurred due to the rerouting of rivers, thereby suddenly increasing drainage gradients, erosion rates, and affecting landscapes. The headcutting of rivers and upgradient drainages has created many "breaks" areas with less developed, erosive soils and soft, erosive geologic materials.

All federal mineral lands in the planning area are open to the operation of the leasing and mining laws unless segregated from mineral entry by withdrawal or closed to leasing or permitting due to law and regulation, or by planning decisions. For example, the Fort Meade Recreation Area ACEC (6,574 acres) has been withdrawn from all locatable mineral entry and closed to oil and gas leasing in a non-discretionary action due to its exceptional natural values and historical, cultural, and recreation values. The Fossil Cycad ACEC (320 acres) is withdrawn from locatable mineral entry and closed to oil and gas leasing under a discretionary action to protect paleontological resources, specifically fossil cycads.

Figure 3-13
Reasonably Foreseeable Development (RFD) Study Area Showing Basins and Uplifts (shaded gradational boundaries)



Source: Western South Dakota; USDI, BLM, Final Report, October 7, 2009

Figure 3-14
Stratigraphic Chart of the South Dakota Study Area with Oil- and Gas-Bearing Zones Indicated

Era	Age		Group	Formation/Rock Member	Hydrocarbons
Cenozoic	Holocene and Pleistocene		*Surficial Deposits*		
	Tertiary	Oligocene	Arikaree	Arikaree	
			White River	Brule	
		Eocene		Chadron	
				Golden Valley ≷ Slim Buttes	
		Paleocene	Fort Union	Tongue River	
				Ludlow ≷ Cannonball	
Mesozoic	Cretaceous	Upper	Montana Group	Fox Hills Sandstone	
				Pierre Shale (includes Eagle and Shannon Sandstone members)	Gas
			Colorado Group	Niobrara Fm	Gas
				Carlile Shale	
				Greenhorn Limestone	
		Lower	Graneros Group	Belle Fourche Shale	
				Mowry Shale	
				Newcastle Sandstone ≷ Dakota Sandstone	
				Skull Creek Shale	
			Inyan Kara Group	Fall River Sandstone	
				Lakota	
	Jurassic			Morrison	
				Sundance (Includes Swift and Reardon members)	
				Gypsum Spring ≷ Piper	
	Triassic			Spearfish	
Paleozoic	Permian			Minnekahta Limestone	
				Opeche Shale	
	Pennsylvanian			[1]Minnelusa	Oil
	Mississippian		Madison Group	Charles	
				Mission Canyon Limestone	
				Lodgepole Limestone	
				Englewood Limestone	
	Devonian			Three Forks Shale	
			Jefferson	Nisku ≷ Birdbear	
				Duperow	
				Souris River	
			Elk Point	Prairie	
				Winnipegosis	
	Silurian		Interlake	Interlake	
				Stonewall Limestone	
	Ordovician		Bighorn	Stony Mountain	
				Red River	Oil
				Winnipeg	
	Cambrian			Deadwood Formation	
Precambrian			*Igneous Basement Rocks*		

[1]Oil production in southwest South Dakota (Eastern Powder River Basin) is from the Leo sandstone, an informal unit of the Minnelusa Formation.

Source: Modified from Fahrenbach et al. (2007).

Minerals Ownership

Within the State of South Dakota

The State of South Dakota (77,116 square miles in size) contains approximately 3,764,000 acres of federal mineral estate underlying approximately 274,000 acres of BLM-managed public surface and 49,354,240 acres of private, county, state, and other federal agency lands, including those managed by the Army Corps of Engineers and the Bureau of Reclamation (see Map 1-3, Mineral Estate within the Planning Area, showing federal subsurface minerals and other agency minerals). Some federal minerals underlying private surface consists only of coal. Small amounts consist of other categories such as coal only, oil and gas only, 50 percent federal minerals, and other miscellaneous groupings.

In South Dakota, the most likely USFS lands to be explored for oil and gas are in Harding and Fall River counties, and exploration for hard rock minerals would primarily occur in the Black Hills.

USFS lands were respectively addressed for the Sioux Ranger District in the "Custer National Forest, Sioux Ranger District Oil & Gas Leasing Analysis Final EIS" (USFS 2004) and for the Buffalo Gap National Grasslands in the "Final EIS and Land and Resource Management Plan – Nebraska and Samuel R. McKelvie National Forests, Oglala, Buffalo Gap, and Fort Pierre National Grasslands" (USFS 2000). The BLM was a cooperating agency in preparing the Buffalo Gap EIS, and a joint lead in the Sioux Ranger District EIS. For the private lands within the USFS administrative boundary, the BLM follows leasing decisions that it made as a cooperator or joint lead in the applicable forest plans.

Within the South Dakota Reasonably Foreseeable Development Study Area

The South Dakota RFD "Study Area" contains approximately 25,838,000 surface acres of all oil and gas mineral ownerships (private, USFS, BLM, NPS, Military Reservation/COE, USFWS, BIA trust, tribal, R&PP) in essentially the western half of the state (available online at http://www.blm.gov/mt/st/en/fo/south_dakota_field/rmp/docs.html; also see Figure 3-15). Total federal oil and gas mineral ownership in the study area is approximately 3,374,000 acres, or about 13 percent of the total acreage. The SD RFD provides an in-depth analysis of federal minerals in the western half of the State of South Dakota, since those are more likely to be developed. Federally recognized tribes and individual allottees own approximately 7,028,000 surface acres, or about 27 percent of total acres; the oil and gas resource on these lands are managed for the owners by the BIA and the BLM as trust responsibilities. The remaining lands, approximately 15,218,000 acres (60 percent) are owned by state and private interests.

Within the RFD study area, the USFS manages the greatest amount of the federal mineral estate, approximately 1,774,000 acres, or about 53 percent. The BLM manages approximately 1,471,000 acres (about 44 percent) of the federal oil and gas mineral lands in the study area, which is discussed in this document. Smaller amounts of federal oil and gas mineral lands within the study area are managed by the NPS (about 103,845 acres, or nearly three percent). Lands in the study area managed by the USFWS are primarily leased or under easement for wildlife habitat management purposes.

BLM-Managed Mineral Estate

In addition to managing public-owned surface minerals, the BLM also manages the Federal minerals underlying private surface. The USFS makes leasing decisions for the federal minerals under USFS-managed federal surface. For consistency, leases of federal minerals underlying private surface (split estate) and surface managed by other agencies within the administrative boundaries of the USFS are issued with leasing stipulations developed by the USFS with assistance from the BLM in either a leasing EIS or as part of a USFS Land Use Plan. The BLM then follows USFS leasing recommendations in processing of any leases for sale which underlie USFS surface, and works with the USFS in the development of those minerals (BLM 2008d Fact Sheet).

The South Dakota RFD contains an error on page 7, "Smaller amounts of Federal oil and gas mineral lands within the Study Area are managed by the National Park Service, Bureau of Reclamation and Military Reservations/Corps of Engineers. Decisions made as part of the Resource Management Plan EIS for the Study Area will not be made for these lands."

In fact, decisions will not be made for NPS lands and USFWS lands. However, decisions will be made in coordination with the Bureau of Reclamation and in coordination with military reservations and with the Corps of Engineers on leasing the federal minerals under these lands (SD Oil and Gas Development RFD 2008. Clarification made by BLM, SDFO. 2010).

The Bureau of Reclamation and Military Reservations/Corps of Engineers also manage small acreages of minerals in South Dakota. Except for the NPS and USFWS lands, decisions will be made in the RMP for these lands in coordination with the surface management agencies.

Leasable Minerals

Leasable minerals include oil, gas, coalbed natural gas, coal (including lignite), and heat-gradient (geothermal) resources. The planning area is generally open to consideration for exploration, leasing, and development for all leasable fluid minerals, which include oil, gas, and geothermal energy, in accord with all applicable provisions (e.g., restrictions and prohibitions). All activities are conducted in accordance with the guidance for mitigation of surface-disturbing activities (e.g., existing lease stipulations and/or new ones adopted in the planning process) and, to the extent possible, incorporate BMPs.

Coalbed Natural Gas

No production of coalbed natural gas has occurred in the planning area. (BLM SDFO 2011)

The most important potential leasable mineral resources in the planning area are hydrocarbons. The long history of oil and gas production, and especially recent developments, documents the presence of source and reservoir rocks, as well as trapping mechanisms that provide a significant hydrocarbon resource.

Principle considerations for leasing mineral resources (from the land use planning standpoint) include the effects of the disruptive activities on other resources in the area including air quality, soils, water resources, vegetative resources, wildlife resources, recreation, cultural resources, and paleontological resources.

The mineral resources on public lands and federal mineral estate can be extracted if they are developed in an orderly and efficient manner. All mineral development must comply with goals, objectives, and resource restrictions (mitigations) required for the protection of the other resource values in the planning area.

Figure 3-15 shows areas that have potential for oil and gas resources in South Dakota. Not all oil and gas resources shown in this figure are recoverable through conventional means. Figure 4-1 in Chapter 4 displays oil and gas resources that are recoverable through conventional drilling methods.

Geophysical Exploration

Geophysical "notices of intent" to conduct seismic exploration are evaluated on a case-by-case basis. All acreage in the planning area will be subject to appropriate limitations (e.g., vehicle use restrictions). In addition, use of explosive charges may not be allowed in any area if analysis determines that unacceptable adverse impacts would occur.

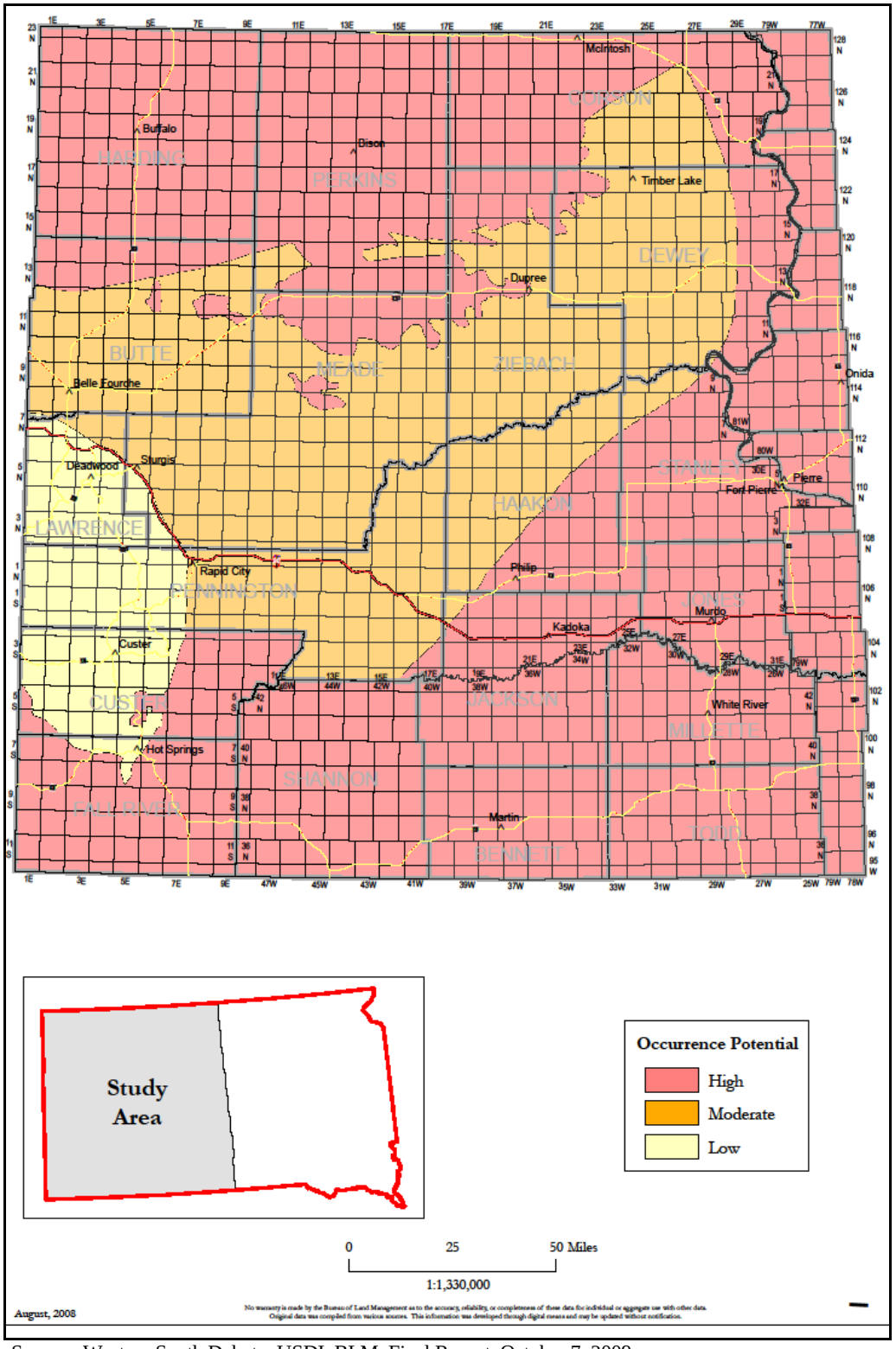
Federal Oil and Gas Leasing

BLM-managed lands in South Dakota are regularly offered for federal oil and gas leasing. Once an oil and gas lease has been issued, it constitutes a valid existing right and the BLM cannot unilaterally change the terms and conditions of a lease, although some very restrictive conditions can come into effect under certain conditions (e.g., a species is designated threatened or endangered). Restrictions are analyzed through the NEPA process and if increased restrictions are warranted they would be placed on new leases offered. Generally, existing leases are not affected by the new restrictions.

Closures and additional lease restrictions cannot be fully implemented until after a lease expires and new leases are issued for the same area. However, additional restrictions can be applied at the Application for Permit to Drill (APD) stage and at subsequent development stages that would mitigate potential impacts from oil and gas operations within existing lease areas as long as rights to develop the leases remain intact.

The BLM evaluates industry-proposed measures to protect health and safety through the drilling permit process. Of particular concern are the requirements of approved contingency plans for hydrogen sulfide (H2S) release; operators can be required to conduct dispersion analyses to determine ambient H2S concentrations during well blowouts, collect onsite meteorological data, prepare detailed evacuation plans, and place offsite warning signs.

Figure 3-15
Potential for Occurrence of Oil and Gas within the South Dakota Study Area
2010 through 2029 (Final - October 7, 2009)



Source: Western South Dakota; USDI, BLM, Final Report, October 7, 2009

In Fiscal Year (FY) 2007, 23 competitive oil and gas leases were issued encompassing a total of 26,748 acres and generating bonus bids of $487,589. In addition, two leases totaling 2,481 acres were issued noncompetitively. In FY 2008, no competitive leases were issued. In FY 2009, four competitive leases were issued encompassing 6,577 acres and generating $36,013 in bonus bids. No noncompetitive leases were issued in FY 2008, FY 2009, and FY 2010.

Within South Dakota, federal minerals produced oil sales of 108,595 bbl with a value of $7,732,756 and generated royalties of $1,272,378 in FY 2010. Unprocessed (wet) gas sales totaled 328,100 mcf, valued at $1,197,397 and resulted in royalties of $146,181.

As of September 30, 2010, 149 federal oil and gas leases were in effect in South Dakota covering 114,314 acres (see Figure 2 of the Oil and Gas RFD, Location and initial status of all wells drilled within the South Dakota Study Area; BLM, RFD 2009).

Regulations at 43 CFR (Public Lands: Interior, subpart 3100 [Onshore Oil and Gas Leasing]: General, 0-3(d) Authority [the Secretary's general authority to prevent the waste and dissipation of public property]) and the Attorney General's Opinion of April 2, 1941 (Vol. 40, Op. Atty. Gen 41) allow the BLM to lease lands that are otherwise unavailable for leasing if oil and gas is being drained from such lands. If the unavailable lands were under the jurisdiction of another agency, leasing of such lands would only occur following consultation (and consent if necessary) from the surface managing agency.

Unavailable lands for this RMP (the NPS and the USFWS lands and minerals; see Figure 3-16) would be leased only if a state or private well is proposed or completed within the same spacing unit or if the lands are within a producing unit. These lands would be leased with a "no-surface occupancy and no subsurface occupancy stipulation" with no waiver, modification, or exception provisions. No well drilling locations would be constructed on these lands nor wellbores directionally drilled under them. Fluid minerals would be obtained by horizontal flow through geologic formations via the decrease in pressure near the wellbores on adjacent lands which would force minerals to flow due to the higher pressure gradient remaining in the federal minerals. After the issuance of a lease, it would be combined with the private or state leases in a communitization agreement, and the U.S. government would then receive revenue in proportion to the lease's acreage interest as it bears to the entire acreage interest committed to the agreements.

Communitization

The aggregating of small tracts sufficient for the granting of a well permit under applicable rules for the spacing of wells, also called "pooling" (Black's Law Dictionary).

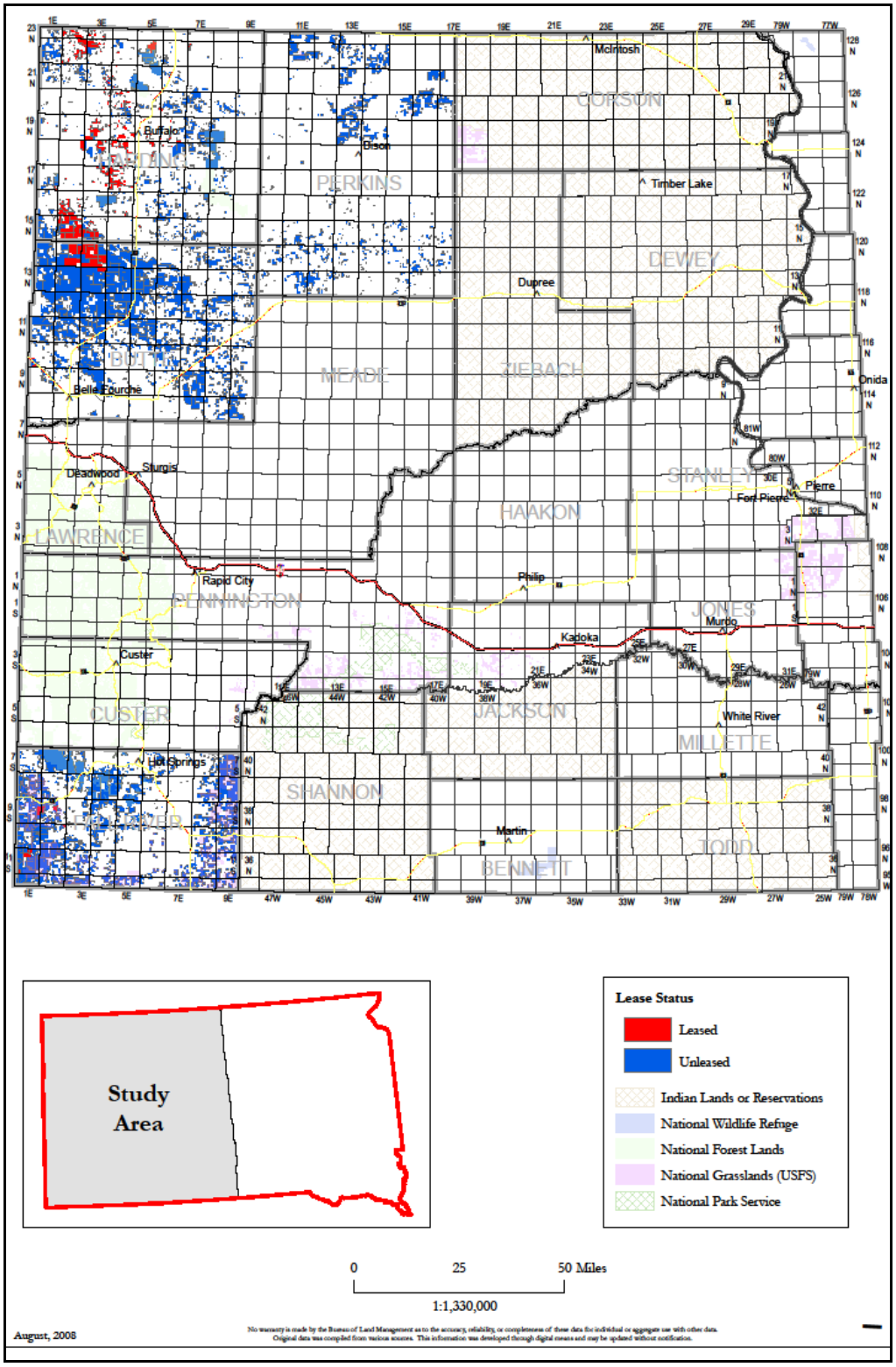
Current Oil and Gas Development Areas

Fall River, Butte, and Harding are the current oil and/or gas producing counties in South Dakota. Although oil and gas exploration has taken place in the state since the late 1800s, and gas production has occurred since then, oil was not discovered until 1954. Increased drilling activity occurred for oil and gas in the mid-1950s, for a few years around 1970 and a number of years in the early 1980s. Recently, increased drilling activity has raised the number of horizontal oil wells in the Red River formation in Harding County; these are driven by production declines, new technology, and higher prices.

Leasing, which is thought to be an indicator of trends, shows the greatest new interest in federal minerals is in Harding County with some interest in Stanley County. There has been general success in finding oil on federal mineral estate in Harding County, but new gas exploration on private minerals in Stanley County has not yielded success; all of seven recent exploratory holes did not yield gas and were considered dry. There also has been a continuous low level of interest in drilling on mostly private lands in Butte and Fall River counties, yielding mixed success. The majority of leased lands are located in northwest South Dakota as shown in Figure 3-16.

Oil production in the planning area became significant during the 1970s, peaked in the mid-1980s, and underwent a decline in the 1990s. Today, South Dakota oil production is largely past the conventional primary production phase. However, new technology and changed economics are making current formations more economically viable to produce and could make previously unexploited formations more attractive for drilling.

Figure 3-16
Leased and Unleased Federal Minerals in Parts of the
Western South Dakota RFD Study Area



Source: Western South Dakota; USDI, BLM, Final Report, October 7, 2009

Water injection techniques have been used in the Alum Creek Field in Fall River County since the early 1990s as a means to increase oil production. Currently oil recovery in the Alum Creek Field oil field has significantly declined, and requires increasing amounts of injected water.

Air injection or fire flood (see Glossary) has been used in the Buffalo Field in Harding County since the early 1980s and has significantly increased production, even though recent signs of declining production require increasing amounts of air injection. Oil production in Harding County has very recently increased with the conversion of some conventional Red River wells to horizontal wells, addition of multiple horizontal legs, and the drilling of new horizontal wells.

Previously thought to be uneconomical, recent developments in technology have made it possible to economically produce natural gas from "tight formations." New techniques, such as hydraulic fracturing of rock in horizontal wells,

increase the permeability of relatively impermeable concrete-like formations. (See Appendices E.8 and E.9 for a detailed discussion of BLM procedures in oil and gas recovery, including Conditions of Approval.) New technology appears to be viable in Butte and Harding counties. In these counties, the potential for conflicts with American Indian traditional and cultural properties has increased as a result of increased drilling (see the Cultural Resources section).

Pipeline Infrastructure

Historically, gas flaring was common in remote areas of western South Dakota due to the lack of an existing gas pipeline. In 1978, a pipeline was built to transport gas to market. Gas production spiked as a result of more drilling after the installation of the pipeline and production has generally been undergoing a slow increase since the late 1970s. Today, drilling for gas tends to be near pipelines and if gas is found in small quantities far from existing pipelines, the well is plugged rather than produced due to the lack of infrastructure to transport the gas.

Pages 13-14 of the RFD Scenario at http://www.blm.gov/mt/st/en/fo/south_dakota_field/rmp/docs.html provide a description of the typical oil and gas drilling and completion sequence. Also see pages 15-18 in the same document for a history of oil development and pages 20-23 for historical oil and gas production figures for South Dakota.

Carbon dioxide sequestration in oil and gas reservoirs in the planning area could have the dual effect of enhancing oil recovery while providing a means to reduce the environmental effects caused by the release of this gas. Injecting carbon dioxide into oil reservoirs, also referred to as "tertiary recovery," has been proven to increase the production in mature oil fields. Carbon dioxide can also be sequestered in unmineable coal seams and saline-bearing formations. Both of these conditions exist in the planning area.

Continually improving new oil and gas technology has allowed for producers to increase the efficiently by which oil and gas is extracted. The improvements in technology have the potential to increase the productivity and life of existing fields. Oil and gas wells within the planning area are predicted by the BLM's RFD Scenario (BLM, RFD 2009) to be drilled at rates as high as an average of 26 wells per year over the next 20 years (see Figure 3-16).

Conditions of Approval

Conditions of approval are mitigation measures from an environmental document which are modified to be applied to a permit. They implement restrictions in light of site-specific conditions. (See Appendix E.9 for examples of mitigation measures which have been applied to approved permits to drill as conditions of approval.) General guidance for conditions of approval and surface operating standards is found in the fourth edition of the BLM and USFS brochure entitled "Surface Operating Standards for Oil and Gas Exploration and Development" (BLM 2007b) and BLM Manual 9113 entitled "Roads." The BLM commonly applies BMPs when approving APDs, and efforts are continuing to make BMPs standard (http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices.html.)

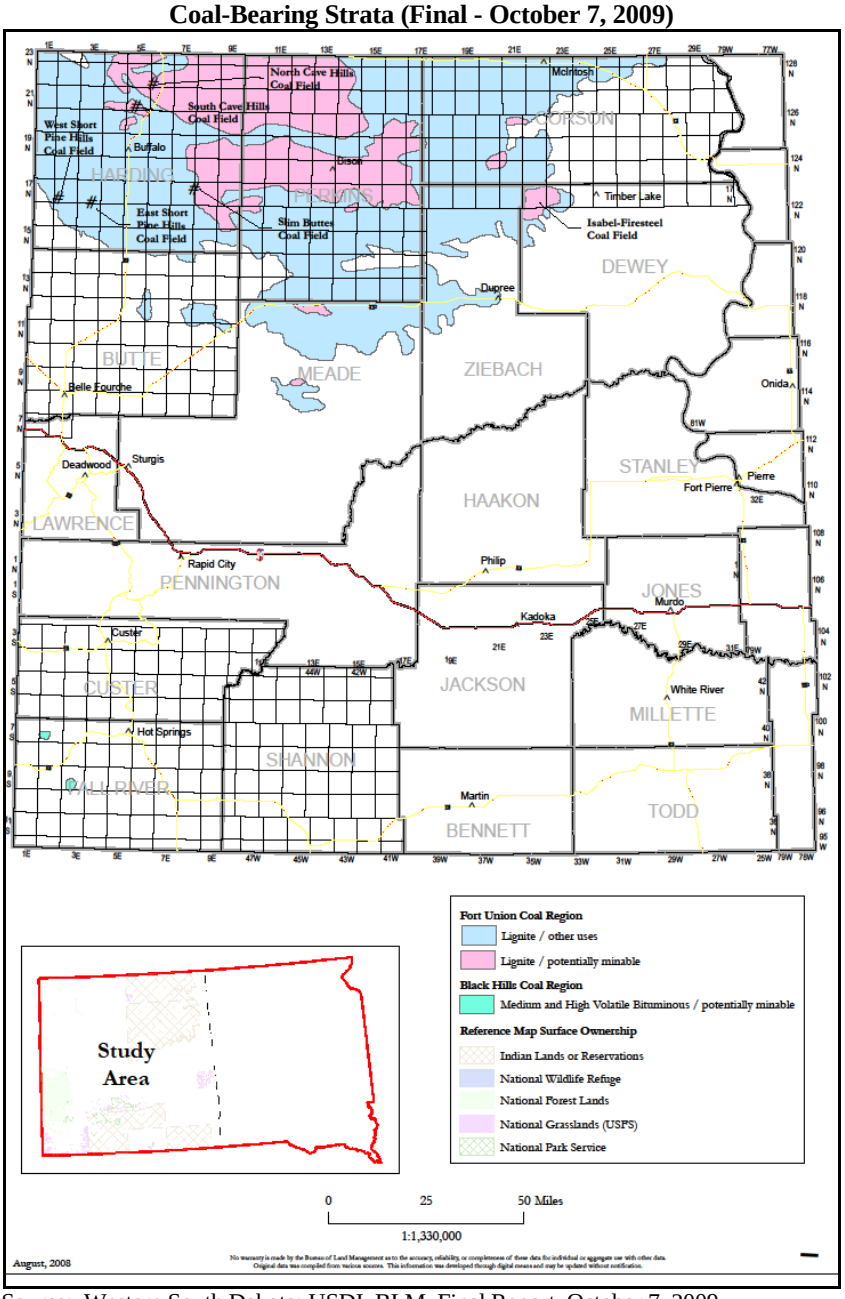
Issuance of Rights-of-Way

ROWs are required for all facilities, tank batteries, pipelines, truck depots, power lines, and access roads that occupy federally managed lands outside the lease or unit boundary. When a third party (other than the operator or the federal government) constructs a facility or installation on or off the lease, a ROW is also required. (Also see the Lands and Realty section for a detailed discussion of ROWs in the planning area.)

Solid Leasable – Coal

Figure 3-17 shows the SD RFD Study Area within the mapped areas of known coal-bearing strata (USGS 2001a and 2001b), which lies within the Fort Union and Black Hills coal regions. The Fort Union coal region contains lignite coals of Tertiary and Cretaceous age, and the Black Hills coal region contains medium and high volatile bituminous coal. Wood and Bour (1988) reported the Fort Union coal region contains up to 20 coal beds greater than 30 inches thick at depths less than 2,000 feet. Few coals are known to exceed a thickness of 10 feet. Rothrock (1947) mapped operating and abandoned coal mines and coal outcrops in northwest South Dakota. This lignite coal was mined within the Study Area on a very small scale from the pioneer settlement days of the early 1890s through the 1930s.

Figure 3-17
RFD Study Area (SDFO) within the Mapped Areas of Known Coal-Bearing Strata (Final - October 7, 2009)



Source: Western South Dakota; USDI, BLM, Final Report, October 7, 2009

Presently, no coal exploration or mining activity is occurring in the planning area. Public lands in the planning area have a low coal development potential and a less profitable stripping ratio than adjacent coal producing states, making development unlikely. No comments or expressions of interest in coal development were received during scoping, and no applications or expressions of interest in coal development have been received during the last 10 years.

Geothermal Energy – Leasable

Geothermal energy is energy from the earth's core that can be used due to the heat gradient difference between the rocks and fluids underground and the ambient temperature conditions on the surface. The greater the difference in temperature, the easier it is to successfully use the geothermal energy for heating purposes, food processing, or for generating electricity through steam power. Where geothermal water is sufficiently hot, it can be used for space heating by pumping the water directly into pipes and radiators; heat pumps can be used to extract the heat from lower temperature water. Geothermal resources are rated by temperature: low temperature, less than 90°C (194°F); moderate temperature, 90°C-150°C (194-302°F); and high temperature, greater than 150°C (302°F).

Some geothermal water contains large concentrations of dissolved minerals, such as sodium, calcium, sulfate, chloride, or iron. These ions have been dissolved from the minerals in the rocks that compose the geothermal reservoirs and vary as the mineral composition of the rocks varies. Concentrations of some constituents usually exceed those in the standards recommended for drinking water by the EPA; thus, geothermal water that is withdrawn and used can become a disposal problem. In South Dakota, reinjection of geothermal water into the ground is required by the SD DENR. Much of the geothermal water contains large concentrations of dissolved solids.

Currently, little geothermal development exists in South Dakota and no high temperature geothermal resources have been identified in the state. The development that does exist is comprised of hot springs developed for recreational use (located in the town of Hot Springs) and a few local heating ventures in the western part of the state, none of which are on public land. The few hot springs are connected by faults to deeply buried reservoirs that contain geothermal water that moves upward along the fault zones to discharge at the land surface.

Geothermal energy resources in South Dakota occur as low 100°C (212°F) temperature geothermal waters in regional scale aquifers within the Williston and Kennedy Basins (see Figure 3-18). The accessible resource base is approximately 12.52 exajoules (a unit measure of energy) in South Dakota (1018 J = 1 exajoule, 1018 J ~ 1015 Btu = 1 quad) (see Table 3-34). Resource temperatures range from 44°C (111°F) at a depth of 550 m (1,804 feet) near Pierre to 100°C (212°F) at a depth of 2,500 m (8,202 feet) in the northwestern corner of South Dakota. Geothermal heat gradients of interest underlie the western half of South Dakota ending approximately at the Missouri River.

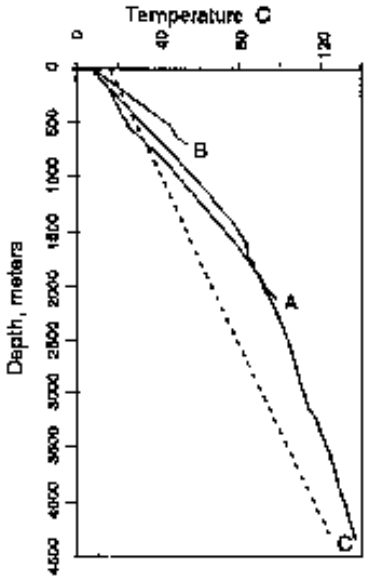
Engineering studies show that geothermal space heating using even the lowest temperature geothermal aquifers 40°C (104°F) in South Dakota is cost effective at the low fuel cost levels in the 1999 economy. The Inyan Kara Group (Cretaceous) is the preferred geothermal aquifer in terms of water quality and productivity. TDS in the Inyan Kara Group ranges from 3,000 to more than 20,000 mg/L 1. Porosities normally are higher than 20 percent, and the optimum-producing zones generally are thicker than 30 m. Deeper formations have warmer waters, but in general, are less permeable and have poorer water quality than the Inyan Kara. An important factor that controls the temperature of the resource in South Dakota is the insulating effect of a thick (500–2,000 m) layer of low thermal-conductivity shales that overlie the region.

A steadily increasing interest in geothermal energy for space heating is a likely long-term trend but is unlikely to affect federal minerals. In addition, interest in commercial power generation has not been expressed in South Dakota.

Large structural basins in parts of South Dakota are possible sources of low-temperature geothermal water, including some from deep wells in the Williston Basin. The temperature of groundwater increases as the depth of burial of aquifers increases because of the geothermal gradient, which is a natural increase in the temperature of the earth as depth increases. The geothermal gradient in the Williston Basin, for example, is about 2°F (1.12°C) per 100 feet of depth; thus, the temperature of the water at the bottom of a well that is 1,000 feet deep would be about 20°F (11.2°C) warmer than the average annual air temperature at the land surface. The water temperature in the four deepest aquifers in South Dakota demonstrates that the water temperature increases as the depth of burial of the aquifers increases.

A steadily increasing interest in geothermal energy for space heating is a likely long-term trend but is unlikely to affect federal minerals. In addition, interest in commercial power generation has not been expressed in South Dakota.

Figure 3-18
Example of Temperature-Depth Profiles for Williston Basin and Kennedy Basin



Source: Downey 1986. A) Williston Basin in northwestern South Dakota; B) geothermal area in Kennedy Basin near Winner, South Dakota; C) Central Williston Basin in North Dakota. The dashed line shows minimum geothermal resource profile; any temperature to the right of the dashed line qualifies as a potential resource.

Table 3-34
Geothermal Resources Base for South Dakota

Formation	*Resource (exajoules)*	*Avg. Thickness (meters)*	*Avg. Temperature (°C)*	*Max. Temperature (°C)*
Dakota	0.42	36.5	18.5	73.4
Jurassic	1.22	81.9	42.5	71.5
Spearfish	0.66	43.8	57.7	82.3
Minnekahta	0.52	36.8	46.4	85.4
Minnelusa	2.02	134.1	47.3	86.5
Madison	2.93	153.7	51.0	90.3
Ord-Dev	2.90	140.2	53.7	97.2
Cambrian	1.85	110.0	56.1	104.8
Total	**12.52**			

Source: Lund 1997.
Note: (Temperatures are given for formation tops. Average thickness values are calculated from top to top. All of the formations named are aquifers which may produce water. Higher temperatures are typical for the Williston Basin in northwestern South Dakota.

Locatable Minerals

Locatable minerals include minerals containing metals such as gold, silver, and copper; and minerals containing fissible elements such as uranium and thorium; as well as nonmetallic minerals such as bentonite, and cement grade limestone.

New locatable minerals claims filed have greatly increased in the last few years along with the increase of commodity prices (see Table 3-35).

According to the 43 CFR 3809.21 (a) and 3809.11 exploration activities which disturb less than five acres on public land can be performed under a Notice of Intent (NOI), but all mining activities that exceed casual use require a Plan of Operations. These regulations also require an operator to prevent unnecessary or undue degradation of the land, require reclamation, and require a financial guarantee sufficient to cover 100 percent of the cost of reclamation of the proposed disturbance. The SDFO currently has on file two active NOIs to mine locatable minerals.

A Plan of Operations must include a mining and reclamation plan and a description of all necessary measures to prevent unnecessary or undue degradation. The BLM also requires a financial guaranty of 100 percent of the estimated cost to reclaim the area. A NEPA analysis and an opportunity for public participation of the proposal is also required as part of the evaluation and approval process. The SDFO currently has one active Plan of Operations on file.

Table 3-35
New Locatable Mineral Claims
Filed in South Dakota

Year	*Number of Claims*
2000	15
2001	44
2002	14
2003	230
2004	17
2005	150
2006	871
2007	736
2008	234
2009	82

Source: MT/Dakota 5/27/09.

Mining Law of 1872

The Mining Law of 1872 provides for the exploration, discovery, and mining of metallic and certain nonmetallic minerals on federal lands. Any U.S. citizen or corporation organized under state laws can locate mining claims. A mining claim is located on federal minerals with valuable deposits of ores or minerals legally defined as "locatable."

Exploration and mining activity on most BLM-administered lands are subject to the Surface Management Regulations found at 43 CFR 3809, which apply to activities that occur or are proposed to occur on BLM surface estate. However, under certain circumstances, these regulations can be applied to federal minerals under private lands, or "split-estate lands," which were obtained via the Stock Raising Homestead Act (SRHA) of 1916.

In designated special management areas, such as ACECs, a Plan of Operations is required for any surface disturbance activities regardless of acreage involved in accordance with 43 CFR 3809.

The public lands in the Exemption Area of the Black Hills contain locatable mineral deposits of gold, copper, lead, zinc, silver, other metallic minerals, and pegmatite crystalline-mineral materials. Igneous intrusions, as well as metamorphic events, have been the predominant factor in the formation of metal mineral deposits and pegmatite minerals. In areas that lie adjacent but outside of the Black Hills, bentonite and uranium are the major locatable minerals. No casual use areas or suction dredge use areas have been identified or designated for use in gold mining.

Uses of Bentonite

- Well drilling
- Used in making steel when mixed with taconite (low grade iron ore)
- Bonding material for metal casting
- Used in detergents and cleansers and as a clumping agent in cat litter
- Binder for animal and poultry feeds
- Used in sealing ponds, ditches, and reservoirs

(Summarized from New World Encyclopedia 2008.)

Limestone and bentonite-bearing shale are locatable minerals produced in large quantities in the western part of South Dakota. Limestone is primarily used for production of cement and construction projects. No production figures are available for BLM lands, since no royalties are charged for federal locatable minerals.

Bentonite, which has many commercial uses, is present in the Cretaceous Belle Fourche and Mowry formations in the northwest corner of the state near Belle Fourche (also see the Geology section). The presence of bentonite is the result of numerous volcanic eruptions that resulted in accumulations of volcanic ash in marine environments which developed into highly expansive bentonite clay. Several of the bentonite-bearing formations are exposed at mineable depths, which have facilitated continuous mining operations since the 1940s.

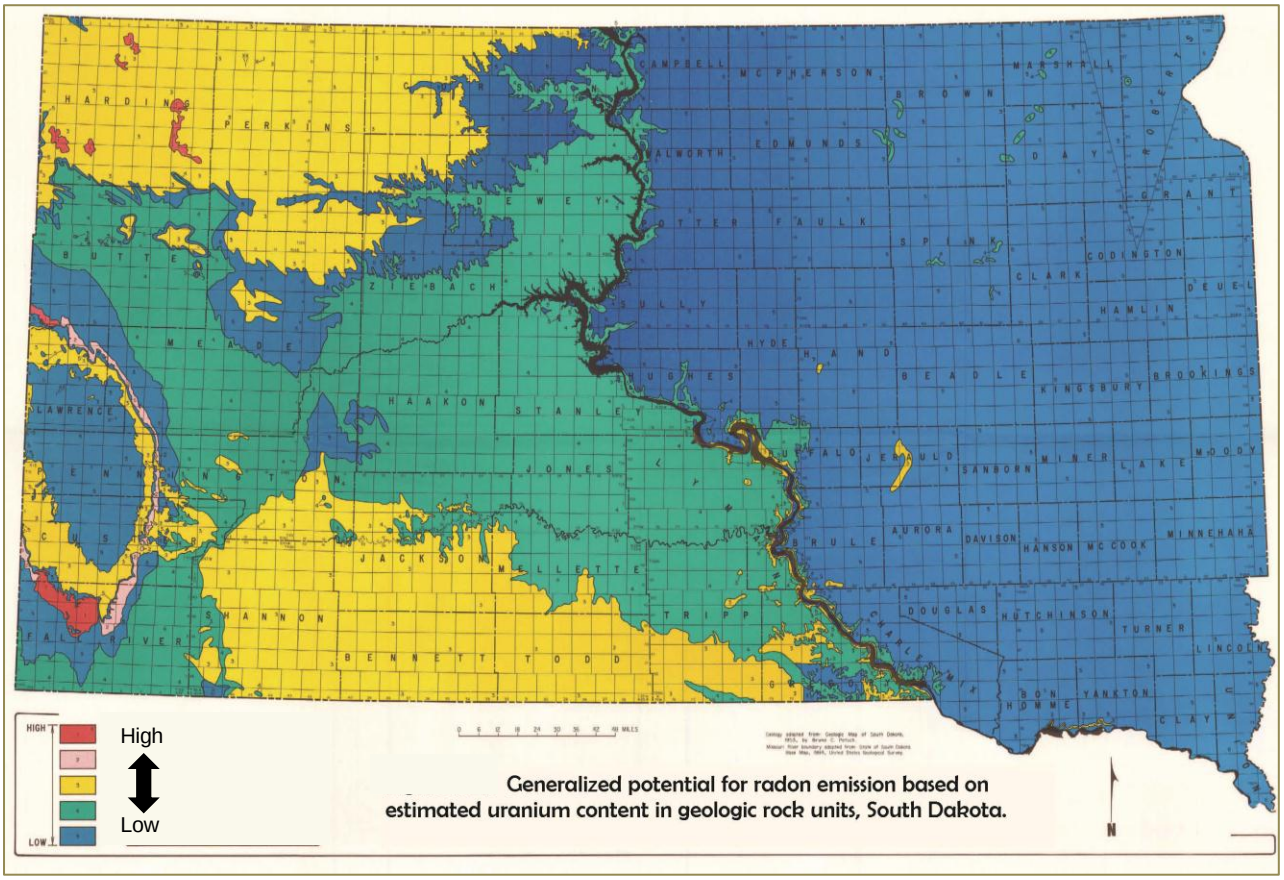
Deposits of bentonite in Butte County have been extensively mined. A typical minable bentonite bed might be about three feet thick. Mining occurs on or near the outcrop of the bentonite bed and results in a relatively shallow excavation.

With the recent high prices of commodities and the sudden rise of interest in bentonite mining in recent years, it is expected that the number of notices may tend to rise in the near future. All federal minerals in the planning area are available for exploration and development unless withdrawn. The only areas currently withdrawn from mineral entry are the Fort Meade Recreation Area and Fossil Cycad ACECs.

Uranium, a naturally occurring element from which atomic energy is derived, is found in a wide range of minerals and varied forms of deposition. It has been mined from shallow sandstone and lignite beds in the northwestern and southwestern counties in the planning area. The uranium found in sandstone generally occurs in the Lakota and Fall River formations of the Inyan Kara Group. Uranium is also known to occur in the lignite beds of the Tongue River and Ludlow members of the Fort Union formation (South Dakota GS 1964).

Currently, interest in mining uranium is burgeoning due to higher prices for uranium caused by energy demand (see Figure 3-19). In the past, uranium has been mined by underground and open pit methods. However, a newer method of mining involving in-situ leaching technology is now a favored method of mining. Uranium bearing formations are exposed along the outer edge of the Black Hills. In-situ leaching would be done at shallow depths in the same formations a little further from the Black Hills and deeper in that formation. TWO RIVER bearing formations are also near the tops of some buttes and hills in the northwestern part of the state.

Figure 3-19
Uranium Resources in South Dakota



Source: Modified from Chadima. (1989)

Exploration for and development of uranium in the southern end of the Black Hills is currently occurring. A small amount of public surface land is involved in the Dewey and Burdock areas. However, uranium mining tends to be controversial due to the legacy of some past mining practices, health effects, and the controversial nature of uranium uses. Concern over potential groundwater contamination also exists.

Extensive limestone formations are exposed in the Black Hills, especially in the outer hogback of the uplift in the Dewey area. The formations have been mined for the production of Portland cement for decades. One of the operations located near Rapid City will reach the end of its reserves of usable, obtainable limestone in several decades. This has resulted in the filing of many mining claims for limestone on federal minerals in the outer portion of the southwestern part of the Black Hills uplift.

Limestone is usually classified as a salable mineral, but according to one provision in the law, it can be a locatable mineral. Under 43 CFR 3830.12c, "Limestone of chemical, or metallurgical grade, or that is suitable for making cement, is subject to location under the mining laws." Plans have begun for a long-range mining proposal to commence decades from now. Limestone mining could potentially affect areas with TCPs, although measures are being taken to avoid them (see the Cultural Resources section for more discussion of TCPs).

As of May 27, 2009, South Dakota had 2,572 active mining claims on BLM, USFS, and private surface estate (see Table 3-36). Claim numbers have greatly increased in the last few years along with the increase of commodity prices. Based on companies involved, most of these recent claims are likely for the mining of uranium, limestone (for making cement), and gold.

Table 3-36
Total Active Mining Claims Found in South Dakota
(BLM, USFS, and Private Surface Estate)

Year	*Number of Claims*
2000	571
2001	597
2002	605
2003	824
2004	838
2005	948
2006	1,824
2007	2,379
2008	2,507
2009	2,572

Source: MT/Dakota BLM 5/27/2009

The SRHA lands (see the sidebar above titled "Mining Law of 1872") refer to patented surface for which the federal government has retained the mineral rights under various acts passed by Congress during the latter part of the active homesteading period (approximately 1906 through 1920). Many mining claims have been made on these lands; in 2007 alone, 68 SRHA mining claims were filed in South Dakota.

Extensive gold mining has occurred in the past in South Dakota, especially in the Black Hills region (see the Geology section for more discussion). Current gold mining currently is at a low ebb, with only one major mine currently operating from a high of five large mines in the 1980s. The SDFO does not currently have any permitted locatable mineral activity in those areas of the Black Hills. In 2008, the one large operating gold mine in South Dakota produced 60,665 ounces of gold worth $52.9 million and 226,000 ounces of silver, worth approximately $3.4 million.

Salable Minerals

Salable minerals include sand, gravel, limestone aggregate, clay/dirt fill, and decorative rock. Currently, no commercial development of salable minerals is occurring on BLM-administered lands in the planning area.

The planning area contains deposits of sand and gravel that originated from fluvial and glacial sources. The BLM issues permits for the use of these materials, which are processed on a case-by-case basis. Appropriate surface disturbance mitigation requirements are included in permits. Most commercially developed gravel sources are privately owned. The SDFO currently maintains no mineral material sites. Sales from these locations tend to be small. Generally, sites are maintained mostly as a public service and are not considered significant revenue generators.

Some decorative stone in the planning area is mined for landscaping and shipped as far away as Nevada and California. The stone currently of greatest interest is colloquially known as "moss rock," which is actually a lichen-covered White River conglomerate formed from stream gravel. Currently, all "moss rock" is being produced from private lands.

If a mineral material site were established on SDFO-administered land, periodically, the material would be appraised and assigned a value. There was an unintentional trespass for collection of decorative rock; this was successfully settled. There was also another trespass for gravel on the Cheyenne River terrace deposits many years ago.

The BLM provides mineral materials to governmental agencies such as counties and cities at no cost; these are known as "Free Use Permits." There was some free use of porcellanite many years ago. Porcellanite is sedimentary rock thermally altered into a brick-like rock by the natural burning of lignite coal. Porcellanite is locally known as "scoria."

On occasion, sites can be opened for a limited time frame to provide material for a specific project. These are called "exclusive sales" or "exclusive free use." Additional costs are not charged for reclamation on these pits, since reclamation is a part of the permit.

Currently, no commercial development of salable minerals is occurring on BLM-administered lands in the planning area.

Renewable Energy Resources

Renewable energy in South Dakota includes solar power, wind, biomass, geothermal, and hydropower resources, with potential for development of all of these, especially wind and biomass. As demand has increased for clean and viable energy to power the nation, consideration of renewable energy sources on BLM lands has come to the forefront of land management planning. In cooperation with the National Renewable Energy Laboratory (NREL), the BLM assessed renewable energy resources on BLM, BIA, and USFS lands in the western United States (BLM and DOE 2003).

Developing renewable energy projects depends on market trends and market value. The demand for renewable energy is illustrated by development projects throughout the West on public and private lands. The importance of renewable energy sources has increased in the planning area as nonrenewable energy prices increase and as the need grows for more and cleaner energy sources.

The SDFO has received inquiries from individuals and companies regarding renewable energy projects. The primary limiting factors in site selection include access to power transmission interconnects, acquisition of permits, and power purchase agreements between the producer and owner of the power lines.

These proposed renewable energy resources will have an effect on aesthetics and viewsheds by affecting things like the texture, harmony, and contrast associated with the visual resources of the planning area. Wind generators, solar panels, and tree removal for biomass production would have a greater impact on viewsheds than geothermal production.

The 1986 SDFO RMP did not address renewable energy development, and no management plans have been written specific to BLM-administered lands to address this type of development in the planning area.

In the planning area there will be greater pressure to develop renewable energy resources on the public lands. The development of more energy-efficient technologies for geothermal, wind, biomass, and solar power will continue to grow with the increasing price of fossil fuels and the increasing demand for energy products. Development of these resources can diversify and improve the area's energy reliability.

In turn, development of these resources will increase the demand for more ROWs and facility authorizations. The demand for alternative energy-related ROWs is expected to increase nationally (USDI, BLM 2008b).

Solar Power

Solar energy development has some potential in the planning area but has not presently been developed except for solar panel installations on individual dwellings. The solar energy potential for South Dakota is estimated at 3,500 to 5,500 watt hours per day (Whr/day), depending on whether concentrating solar power (CSP) technology or a flat-plate photovoltaic technology is used.

Concentrating Solar Power (CSP)

CSP technology uses sunlight concentrated on a single point to generate power. The BLM/NREL study (BLM and DOE 2003) indicates that the potential for this type of renewable energy lies primarily in states to the south and southwest of South Dakota. No BLM lands within the planning area were identified as having potential for this type of energy source. Solar energy on BLM land is currently being studied in a six-state area in the southwest (Arizona, California, Colorado, Nevada, New Mexico, and Utah). The BLM and U.S. Department of Energy released a Supplement to the Draft Programmatic EIS for the six-state area in October 2011. The study includes BLM lands with solar insolation levels greater than 6.5kWh/m2/day and slopes of less than 5 percent. Solar insolation levels in western South Dakota have an annual average value ranging from 4 to 4.25 kWh/m2/day. Values greater than or equal to 6.0 kWh/m2/day are considered optimal to warrant commercial scale development. Due to the unlikelihood of commercial solar development in the planning area, allocations for solar development are not addressed further in this planning document.

Wind

Proposals to place wind energy facilities on BLM-administered lands would be processed under lands and realty right-of-way regulations and guidance. Current management is provided by IM No. 2009-043, dated December 19, 2008 (USDI, BLM 2008c). This IM updates and replaces the Wind Energy Development Policy (IM No. 2006-216), issued August 24, 2006. The new IM requires that the initiation of any new planning effort to create, revise, or amend a BLM land use plan will comply with the policy provided in the IM. BLM continues to develop and refine policy and guidance on wind energy planning and development. South Dakota generated 26 percent of their electricity from wind power during 2013 with 783 MW produced. Nationwide SD ranks 18th in the amount of MW produced from wind turbines. Currently 13 wind projects with 474 turbines are in operation in the state. As of 2014 wind projects capable of an additional 79.6 MW are under construction. All utility level wind farms are located in eastern SD. Four wind energy equipment manufacturing facilities are in operation in the state (http://www.awea.org/Resources/state.aspx?ItemNumber=5185). Existing large scale wind projects in SD are shown in Table 4-7.

Wind Energy Rights-of-Way

Applications for a ROW grant may be submitted to the SDFO for one of the following types of wind energy projects:

- A site-specific wind energy site testing and monitoring ROW grant for individual meteorological towers and instrumentation facilities with a term that is limited to three years;
- A wind energy site testing and monitoring ROW grant for a larger site testing and monitoring project area, with a term of three years that may be renewed, consistent with 43 CFR 2807.22 and the provisions of the IM beyond the initial three-year term; and
- A long-term commercial wind energy development ROW grant issued with a term that is not limited by the regulations, but usually in the range of from 30 to 35 years.

Wind power development potential is rated in classes ranging from 1-7.

No wind farms are presently on or adjacent to BLM-administered lands in the planning area, but the majority of BLM lands are in high potential wind power classes. The SDFO has received inquiries investigating the potential for wind energy development in Butte and Pennington counties in the western part of the state. The SDFO granted a right-of-way in 2011 for two meteorological test towers in the southern portion of Butte County.

South Dakota has wind resources consistent with utility-scale production (the state is rated fourth nationally for wind energy potential and it is estimated that it could produce 1,030 billion kilowatt hours per year, or B KWh/yr). Good-to-excellent wind resource areas are located throughout the state, and there is additional potential for small wind turbines in some areas. For wind energy potential, the planning area is almost entirely classified in the fair-to-excellent categories which have the potential of 300 to 600 W/hr. Prominent excellent-to-outstanding wind resource areas are located on the hills east of Pierre, the ridges in south-central South Dakota near the Nebraska border, and the hills near Rapid City. Ridge crest locations in

the Black Hills and other locations can also provide excellent wind resources, although the rugged terrain imposes some limitations on development of moderate to large scale wind farms within the Black Hills.

Approximately 8 percent or 23,230 acres of BLM surface estate in western South Dakota are in the low to moderate wind energy potential classes (Classes 1-2), 15 percent or 39,910 acres are in the moderate class (Class 3), and 76 percent or 209,818 acres are in the high wind energy potential classes (Class 4-7). Less than 1 percent or 1,028 acres are not classified. See Table 4-70 for more detailed information.

In 2009 the South Dakota Wind Energy Association was formed to create a blueprint for wind energy development in South Dakota and to provide a forum for education, research and information about wind energy. Information about the Association can be found at http://www.sdwind.org/.

Biomass

The Black Hills has woody biomass potential of 200,000 tons per year; BLM-administered lands would have only a small portion of this total. Biomass production from grasses would have very little potential but is another consideration. Generally, production of biomass would result from management of forests and woodlands and guided by BLM's forestry program. In the event a biomass generation facility was proposed on BLM lands, such a proposal would be processed under lands and realty right-of-way regulations.

According to USC 15855, "Grants to Improve the Commercial Value of Forest Biomass for Electric Energy, Useful Heat, Transportation Fuels, and Other Commercial Purposes" (Energy Policy Act of 2005, Sec. 210), the Interior Secretary may "make grants to any person in a preferred community that owns or operates a facility that uses biomass as a raw material to produce electric energy, sensible heat, or transportation fuels to offset the costs incurred to purchase biomass for use by such facility."

Biomass

Biomass is biological material derived from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels used as a renewable energy source. Biomass is commonly plant matter grown to generate electricity or produce heat. (from wikipedia.org, 6/18/10)

The trend for biomass energy development in South Dakota is very high, but the major portion of the development will be on private lands in the growth of corn, soybeans, and switchgrass. Potential also exists for cellulose-based energy development from woody products in the Black Hills portion of the planning area; however, the BLM's percent of the total production would be very small due to the small amount of acres of timber in the planning area.

Geothermal

Geothermal resource development in the planning area has historically been used on a limited scale. It has included direct use of thermal water by ranchers for space heating and grain drying. Geothermal energy has also been used to heat school, public, and commercial buildings and for recreational pools and spas, and it has even been used in the fish farming industry.

However, even with this development, the geothermal potential in South Dakota is considered medium; the total potential capacity for direct thermal use is at 2,592 megawatts (geothermal-biz.com). Additional information on geothermal resources can be found in the Mineral Leasing section. Any proposals for geothermal development on BLM-administered lands and minerals would be processed under leasing regulations for geothermal resources. Additional information on geothermal resources can be found under the geothermal discussion in the Minerals section of this chapter.

Hydropower

Hydropower has been developed mainly on the Missouri River in South Dakota, with a few power plants scattered in various other places around the state. The current potential for new large hydropower development in the planning area is low. Increased potential will come if new technologies are developed that will increase the efficiencies of existing facilities. Proposals for hydropower development on federal lands would generally be authorized under FERC authority, but in consultation with BLM on mandatory license provisions.

Special Designations

Special designated areas for the BLM include ACECs, Back Country Byways, National Recreation Areas, National Trails, Wild and Scenic Rivers, Wilderness Areas, and Wilderness Study Areas. Current designations in the planning area include ACECs, Back Country Byways, and National Trails. These areas have special values that warrant special management or protection. In addition, other areas were reviewed for special values that would make them suitable or new designations based on criteria developed by the BLM.

Areas of Critical Environmental Concern

ACECs are unique designations within the BLM. BLM regulations (43 CFR 1610.7-2) define a potential ACEC:

> "(a) The inventory data shall be analyzed to determine whether there are areas containing resources, values, systems or processes or hazards eligible for further consideration for designation as an ACEC. In order to be a potential ACEC, both of the following criteria shall be met:
> (1) *Relevance.* There shall be present a significant historic, cultural, or scenic value; a fish or wildlife resource or other natural system or process; or natural hazard.
> (2) *Importance.* The above described value, resource, system, process, or hazard shall have substantial significance and values. This generally requires qualities of more than local significance and special worth, consequence, meaning, distinctiveness, or cause for concern. A natural hazard can be important if it is a significant threat to human life or property.
> (b) The State Director, upon approval of a draft resource management plan, plan revision, or plan amendment involving ACECs, shall publish a notice in the Federal Register listing each ACEC proposed and specifying the resource use limitations, if any, which would occur if it were formally designated. The notice shall provide a 60-day period for public comment on the proposed ACEC designation. The approval of a resource management plan, plan revision, or plan amendment constitutes formal designation of any ACEC involved. The approved plan shall include the general management practices and uses, including mitigating measures, identified to protect designated ACEC."

Nominations for ACECs are reviewed by an interdisciplinary team to determine whether or not they meet the relevance and importance criteria in the BLM Manual 1613.1 (BLM Areas of Critical Environmental Concern 1988).

ACECs - Currently Designated and Nominated for Continued Designations

The Fort Meade Recreation Area ACEC and Fossil Cycad ACEC are currently designated ACECs and are nominated for continued designation. They were designated to provide special management and protection to areas with special characteristics. The review of the areas found the Fort Meade Recreation Area ACEC and the Fossil Cycad ACEC meet the relevance and importance criteria (Appendix T). A detailed description of these two areas follows. Maps of these ACECs can be found in Figure 2-1.

Fort Meade Recreation Area ACEC

This 6,574 acre ACEC (see Figure 2-1) was designated in 1996. It is managed to protect the regionally significant historic and cultural resources of the old Fort Meade Military Reservation, which was established in 1878 as a cavalry fort to protect the new settlements in the northern Black Hills. Those regionally significant historic and cultural resources are still distinctive and meet the relevance and importance criteria for an ACEC designation. Management decisions for this ACEC are contained in the Fort Meade Recreation Area ACEC Management Plan (USDI, BLM 1996). The recreation area is managed for numerous uses which do not conflict with or damage its cultural and historic resources. These uses currently include grazing, forest product removal for wildlife and fire risk treatments, and non-motorized recreation activities such as hiking, mountain biking, horseback riding, picnicking, camping, wildlife viewing, and hunting. Motorized public travel is limited to the one designated Back Country Byway route. Travel off roads under a permit and administrative use are allowed. The Centennial Trail, a National Recreation Trail, winds approximately 10 miles through the ACEC.

The recreation area is also used under an MOU by the Army National Guard's Regional Training Center, based at Fort Meade, for tactical and land navigation training, and by the U.S. Air Force for survival and escape/evasion recertification. Special recreation permits have also been issued for horse endurance rides, guided turkey hunts, mountain bike demonstrations and races, sheepdog trials, and large group gatherings such as weddings.

Two R&PP leases are in effect on Fort Meade (see the Lands and Realty section for more detail). They are the muzzleloader range just north of Highway 34 and the VFW chapel and parking lot located at the south end of the Back Country Byway.

Fossil Cycad ACEC

This 320 acre ACEC (see Figure 2-1) was designated in 1999. It is managed to protect paleontological resources, more specifically, fossil cycads, which exist in few other places in the world. Management decisions for this ACEC are contained in the Montana-South Dakota ACEC amendment (BLM 1999). The site, located near Edgemont in the southwestern part of the state, is presently being grazed by livestock. Cross-country motorized travel is authorized for the grazing lessee. South Dakota State Highway 18 bisects the BLM parcel.

The site had been looted before it was designated as an ACEC, with visible evidence of the stolen cycads. It is likely there are additional remnants buried beneath the surface; however, restrictions are in place to protect the area from collecting and digging; no interpretive signs highlight the possibility of additional cycads to reduce attention to the area. The relevance and importance criteria continue to be met for ACEC designation in this unique paleontological area.

National Back Country Byways

National Back Country Byways

A system of roads and trails that pass through public lands with high scenic or public interest value. (www.blm.gov/st/en/prog/rec)

A Back Country Byway is a road segment designated as part of the National Scenic Byway System. The BLM's SDFO has a designated byway within the Fort Meade Recreation Area ACEC. The north entrance to the byway is one-half mile east of Sturgis, off South Dakota State Highway 34 about 200 yards west of the entrance to the Fort Meade Veterans Affairs Hospital, the former site of Fort Meade's Post Headquarters area. The south terminus is off Interstate 90, Exit 34, adjacent to the Black Hills National Cemetery. The byway, marked as "BLM Road," is a Type 1 gravel road approximately 4.6 miles in length that averages about 28 feet in width and is narrower in some locations. The road winds through forested hills and grasslands on the eastern edge of the Black Hills. Information kiosks are located near both ends and seven historic site interpretation signs provide visitor information at pullouts or parking areas along its length.

The byway passes by many notable sites including Camp Fechner, a CCC camp during the 1930s and then a prisoner-of-war camp in later WW II; the Fort Meade Cavalry Cemetery; historic cavalry jumps; the Ute Indian Camp; the Deadwood – Sidney Freight Trail; Curly Grimes' grave; and two BLM camping areas. The 111 mile long South Dakota Centennial Trail, a part of the National Trail system, is near the byway for part of its distance and the byway crosses over it twice.

National Recreation Areas

No designated National Recreation Areas are located within lands managed by the SDFO. No proposals or likely areas have been identified, and none are anticipated in the future.

National Historic Trails

Approximately 480 miles of the Lewis and Clark National Historic Trail transects the planning area from the southeast corner to the north central part of South Dakota. The trail is located in the water course of the present Missouri River and its reservoirs. The Lewis and Clark National Historic Trail is a historic trail based on the early expeditions of a group of men called the Corps of Discovery led by Captains Meriwether Lewis and William Clark, a Trader/Trapper interpreter, his Indian wife and infant that extends from the Midwest to the Pacific Northwest. Related historic sites and other points of interest in South Dakota where Lewis and Clark visited when traveling the National Trail include Elk Point, South Dakota;

Spirit Mound State Park in Vermillion; the Lewis and Clark Visitor Center near Calumet Bluff at Gavins Point Dam; the Lewis and Clark Recreation Area in Yankton, South Dakota; a Keel Boat Replica at Chamberlain, South Dakota; Fischer's Lilly Park at Fort Pierre, which is the site of council meeting with Teton Sioux; Memorial to Sacagawea at Mobridge, South Dakota; and site of Fort Manuel, the Missouri Fur Company Post where Sacagawea died December 20, 1812. All of these related sites as well as the National Trail itself are located on lands administered by other Federal, State, Tribal or private land owners. None of these related sites are located on lands with BLM federal surface or subsurface administration.

National Recreation Trails

Portions of two National Recreation Trails – the Centennial Trail and the George Mickelson Trail – cross BLM-administered land. The BLM has management responsibility for a portion of the Centennial Trail on the Fort Meade Recreation Area ACEC, while the State of South Dakota manages the George Mickelson Trail.

Approximately 10 miles of public land is crossed in the Fort Meade Recreation Area by the 111 mile long Centennial Trail, which starts at Wind Cave National Park near Custer in the southern Black Hills and terminates at Bear Butte State Park northeast of Sturgis. The trail enters the Fort Meade Recreation Area at its southern end from the Black Hills National Forest following the trace of Alkali Creek. The trail then crosses under Interstate 90 and continues to follow the creek to the BLM's Alkali Creek Recreation Site Trailhead.

From the trailhead, the trail passes the Horse Camp before climbing a wooded hogback. After this, it proceeds through the forest and meadows of the Black Hills foothills and then past Camp Fechner. (The BLM's Fort Meade Trailhead is conveniently located adjacent to State Highway 34, east of the Veterans Affairs Hospital). The trail passes over State Highway 34, across Bear Butte Creek, and through rolling hills and prairie and then across the boundary to Bear Butte State Park. Non-motorized travel is permitted on the Centennial Trail, and the area sees quite a bit of equestrian use.

The George Mickelson Trail starts in Deadwood and follows an abandoned rail line 109 miles to Edgemont in the southwestern part of the state. The SDFO manages the resources on the land the trail passes through, but the trail itself is managed and maintained by SDGFP under an agreement. Scattered tracts of BLM land are crossed by approximately 10 miles of the George Mickelson Trail; snowmobiles are permitted on this portion of the trail.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act (WSRA) of 1968 established a method for providing federal protection for certain of our country's remaining freeflowing rivers, preserving them and their immediate environments for the use and enjoyment of present and future generations. Section 5 (d) (1) of the WSRA directs federal agencies to consider potential wild and scenic rivers in their land and water planning processes. To fulfill this requirement, the BLM inventories and evaluates rivers and streams when it develops an RMP for BLM land in a specified area.

The inventory process uses the National Rivers Inventory (NRI; managed by NPS) to identify potential wild and scenic waterways in the planning area; these potential waterways may include a river, stream, creek, run, kill, rill, or small lake.

To be eligible as a wild and scenic river, a river segment must be freeflowing and possess at least one river-related value considered outstandingly remarkable. To be assessed as outstandingly remarkable, a river-related value must be a unique, rare, or exemplary feature that is significant at a comparative regional or national scale. (In this case, the planning area was used as the regional scale.)

According to NRI direction, where a particular river segment is predominately non-federal in ownership and contains interspersed BLM-administered lands, the BLM shall evaluate only its segment as to eligibility and defer to the state or to the private landowners' discretion as to their determination of eligibility. This is the case in western South Dakota where only 10 miles of the potentially eligible 206 mile segment of the Cheyenne River has BLM land adjacent to it (see Table 3-37). The BLM has 28 parcels that intersect the ½ mile wide rivers study boundary of the Cheyenne River from Lake Oahe to Slate Springs Draw in Section 1 T8S R6E.

Table 3-37
NRI Rivers within the Planning Area with Adjacent BLM Land

River Name	*County*	*River Segment*	*Total Segment Length (miles)*	*BLM Segment Length (miles)*	*BLM Land* (acres)*
Cheyenne River	Ziebach Haakon Meade Fall River Pennington Custer Shannon	Lake Oahe to Slate Springs Draw (Sec. 1, T8S R6E)	206	10	1,071

*Shoreline and adjacent lands within ¼ mile of the river segment mile measured from the ordinary high water mark.
http://www.nps.gov/ncrc/programs/rtca/nri/states/sd.html

The SDFO identified and evaluated the BLM-influenced river segments to determine their potential inclusion in the National Wild and Scenic Rivers System per Section 5(d) of the WSRA (report available upon written request). This process is a three-step assessment: determine eligibility, assign tentative classification of rivers found to be eligible, and a determination of suitability.

In evaluating eligibility for the BLM managed river segments, it was determined that while these segments are freeflowing, Outstandingly Remarkable Values are not present on the BLM-managed portions (Appendix U). Therefore, these segments have been determined ineligible for inclusion in the National Wild and Scenic River System.

Wilderness Areas

There are no designated wilderness areas in the South Dakota Field Office. FLPMA directs the BLM to manage the public lands and their resources under its jurisdiction under principles of multiple use and sustained yield. FLPMA also identifies wilderness values as part of the spectrum of public land resource values and uses to be considered in the BLM's planning, inventory, and management activities. A BLM wilderness area is an area of public lands that Congress has designated for the BLM to manage as a component of the National Wilderness Preservation System in accordance with the Wilderness Act of 1964

Wilderness Study Areas

There are no Wilderness Study Areas within the South Dakota Field Office (or planning area). Public lands were inventoried in the 1980s to determine if they contained wilderness characteristics. Some of the criteria used in the WSA inventory were naturalness, solitude, primitive and unconfined recreational opportunities, special features, and manageability. Those areas found to have wilderness characteristics were identified as WSAs and all other land was eliminated from further consideration in the wilderness review. No BLM-administered lands in South Dakota were identified as WSAs during the 1980s inventory.

Wilderness Study Areas

A Wilderness Study Area (WSA) is a parcel of public land determined through intensive inventories to meet the definition of wilderness in Section 2(c) of the Wilderness Act. In addition to inventorying lands for wilderness characteristics and identifying WSAs, FLPMA mandated that the BLM would also study those lands for wilderness suitability, and that based on this review, the Secretary of the Interior would forward wilderness recommendations to the President (BLM. 2005. H-1601-1).

Support

Interpretation and Education

Ongoing outreach and educational activities in the planning area are described below. Additional information about interpretation can be found under Use Categories in the Cultural Resources section, and in the Transportation and Facilities section.

Fort Meade Recreation Area ACEC. One goal of the 1985 SD RMP was to develop an educational interpretive program to increase public understanding and awareness of the resources and ecology of the Fort Meade Recreation Area ACEC. The objectives were to instill visitors with a sense of the area's cultural and natural history and reduce vandalism within the ACEC through the use of visitor education. The 1996 RMP Plan Amendment and EA for the Fort Meade Recreation Area ACEC (BLM 1996) also promoted the interpretation of resources including actions to promote interpretation and signing along the Back Country Byway.

The nature trail behind the campground, the byway interpretive brochures, and the signed vehicle pullouts with descriptions of historical sites were created in response to these objectives. A campground host combined with a BLM law enforcement officer presence has also been effective in educating visitors and reducing vandalism.

Kids' Fishing Day. The SDFO works with the State of South Dakota, other federal agencies and local organizations to host a kids' fishing day each year. This event is held in early June and provides information to children and parents about fishing techniques, management of fisheries, and conservation.

Camp Oasis GPS Learning Box. Camp Oasis is a local youth activities/daycare organization, where the SDFO staff has taught the GPS learning box to provide youth with an introduction to GPS and orienteering.

Public Lands Day. The SDFO hosts two Public Lands Days during the spring and fall each year. During these events, the BLM utilizes volunteer labor to maintain trails, fix camp facilities, and clean up litter. From an outreach standpoint, Public Lands Day is beneficial as it provides an opportunity for the BLM to interact with the public and educate them on the variety of resources and resource uses that occur on public land.

SDFO Website and Newsletters. The SDFO website is maintained to provide up-to-date information and education to users via the Internet. This website (http://www.blm.gov/mt/st/en/fo/south_dakota_field.html) contains a recreational newsletter that describes recreational events and other activities that occur at the Fort Meade Recreation Area. A range newsletter is also published once a year (see the Rangeland Management discussion below).

Outdoor Shows and Events. The SDFO periodically staffs a booth or co-sponsors a booth at event fairs or shows and provides interpretive materials on wildlife, wildland fire fuels and fire prevention, noxious weeds, wild horses and burros, and other public lands-related resources and uses.

The SDFO has participated in the Black Hills Roundup Rodeo event by building and presenting a float for the rodeo parade over the 4th of July weekend in Belle Fourche. Frisbees, water bottles, and other items are distributed during the parade. Wildfire prevention and managing for healthy lands have been some of the themes promoted by the SDFO during this event.

Noxious Weeds. Noxious weed informational brochures are distributed at meetings with grazing associations where information about new infestations of weeds is also discussed. Brochures emphasizing the need to use weed-free hay are also made available at the Fort Meade Horse Camp. In addition, the SDFO networks with local county governments regarding weed control at various weed control meetings and conferences.

South Dakota Project Learning Tree. The SDFO works with the South Dakota Project Learning Tree throughout the year by participating in a variety of events and workshops. Students from the very young to adults receive an informative opportunity to learn more about the environment and ecosystems through educator workshops, science days, walks in the

forest, and other sponsored events. This effort increases awareness and appreciation of the environment and helps develop the commitment and skills to address environmental issues.

Firewise. The SDFO works cooperatively with cities and counties to provide wildfire prevention/educational activities to homeowners and the general public. These prevention/educational activities are outlined and discussed in the completed Community Wildfire Protection Plans that have been developed by the counties in coordination with the BLM. Some of the activities conducted include site/home assessments, newsletters, and participation in events/workshops. The goal of these activities is to provide homeowners and the general public with an understanding of the impacts that wildfire can have and ways to mitigate the risks that are associated with wildfire.

Area Publications. The SDFO and the Montana/Dakotas BLM work with other agencies and organizations to co-fund various publications that are specific to the area, including pamphlets, brochures, laminated field books, and books. Some examples of recent publications include the Pocket Book for Identification of Grassland Birds in the Northern Great Plains (Rocky Mountain Bird Observatory 2010); Weed Handbook, Series 1-55 (BLM 2003); and Mushrooms and other Fungi of the Black Hills (Gable and Ebbert 2004).

Rangeland Management. The South Dakota Youth Range Camp provides students with training in range management and stewardship of natural resources. This camp is sponsored by the South Dakota Section of the Society for Range Management (SRM). A portion of the range camp is held at the Fort Meade Recreation Area each June for students who belong to 4-H or Future Farmers of America. SDFO employees assist with plant identification and range contests. The SDFO also invites grazing lessees to accompany field staff as they complete assessments of rangeland health each year. The assessments provide an opportunity for BLM staff to explain concepts of monitoring and rangeland health and plant identification in a field setting.

A range newsletter is mailed out to lessees and local government agencies each year. This newsletter is designed to update grazing lease holders and other local government agencies on new direction and emerging issues on BLM-administered rangelands. This newsletter is posted to the SDFO website.

Transportation and Facilities

Transportation

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

The BLM recently changed the terminology for defining, describing, and categorizing linear assets. Below are the new standardized terms and their descriptions (BLM Technical Note 422). However, the current policy of road classification will remain in place until implementation of travel management planning following the signing of the Record of Decision for this RMP.

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 standard.

Trail: A linear route managed for human-powered, stock, or OHV forms of transportation or for historical values. Trails are not generally managed for use by four-wheel drive or high clearance vehicles.

The transportation system includes state, county, and BLM roads. Various government entities and individuals acquire ROWs from the BLM for those portions of the transportation system roads that cross BLM land. Issuing a ROW is based on access needs and resource considerations. State and county system roads are usually constructed and maintained to higher standards than BLM roads and provide access to and through BLM lands.

Road Maintenance

Roads with the highest public use receive regular routine maintenance. Using native-surfaced roads during the wet season may contribute to irreparable road and resource damage. Concerns about public safety and the potential for resource and road damage may cause road closures during inclement weather. Each BLM road within the planning area will have a maintenance intensity associated with it; however, this will be deferred until travel management planning is done after the Record of Decision is signed.

The inventory and management database for roads, buildings, recreation and administrative sites, trails, and historic structures is the BLM's Facility Asset Management System (FAMS). Cattle guards, bridges, and culverts on the road system are constructed and maintained using available funds. These above-mentioned facilities are monitored and maintained as part of the transportation and facilities program and are recorded in the FAMS.

Roads in the planning area provide access for recreationists, ranchers, resource specialists, and administrators. To date, the SDFO has never completed a comprehensive, formal transportation plan to determine which roads will be included in a formal transportation system. Therefore, the SDFO is working to complete an inventory of all roads in an effort to depict a baseline road system. Identification of travel management areas will be included in the RMP, but travel management planning will be deferred until the RMP is implemented after issuance of the Record of Decision.

The only BLM road in the planning area receiving annual maintenance is the Fort Meade Back Country Byway in the Fort Meade Recreation Area ACEC. It is a two-lane, wide, graveled, crown and ditched road about four and one-half miles in length running between Interstate 90 Exit 34 and State Highway 34 east of Sturgis. It provides access to the developed camping areas along Alkali Creek, the South Dakota Centennial Trail and two of its trailheads, and the Fort Meade Cavalry Cemetery. Along its route are information kiosks and pullouts for historic points of interest. The byway is passable by passenger car but is normally closed during the winter or when travel is unsafe.

The other BLM administrative roads in the south portion of the Fort Meade Recreation Area ACEC are the Hooper Dairy Road and the Philtown Road. The Hooper Dairy Road is maintained by its ROW holders, the City of Sturgis and the residents of the old Hooper Dairy farm property. The Philtown Road was closed as an action in the 1996 Fort Meade Recreation Area ACEC Plan. However, it is still open two weeks a year during the Sturgis Motorcycle Rally in August to facilitate travel of patients and employees to and from the Fort Meade VA Hospital and to allow emergency services a way around increased traffic congestion. During this time period, the SDFO maintains it in safe condition for its 15 mph speed limit.

The portion of Fort Meade Recreation Area ACEC north of State Highway 34 has one motorized vehicle road which provides access to the Fort Meade Reservoir enclosure from Meade County's 3T Road (Old Highway 79). This motorized vehicle road is about one-half mile long and terminates at a parking area by the dam face. A small parking area with a picnic table and a unisex toilet and a pullout with a picnic table are also there. The road is not heavily traveled and is therefore graded every two years and graveled as necessary.

All other BLM roads crossing lands administered by the SDFO are maintained by the individual counties as part of their transportation network. Presently, the SDFO maintains no primitive roads or trails for public use by motorized vehicles but may identify some requiring maintenance when a travel plan is written.

As noted in Chapter 1, specific management actions relating to OHVs such as road/area closures, season of use, signing, cross-country travel for game retrieval, and designating trails in each area will be addressed in detail in the future in a travel management planning document, not in this plan. The data from the transportation inventory work is currently ongoing and will be finalized to be used as a starting point to develop a preliminary travel network when a comprehensive travel plan is completed.

The SDFO faces many challenges with management of transportation systems. The main difficulty is that the comingled nature of land tenure within the planning area results in roads that cross portions of public land; these roads extend to private land or land administered by other state and federal agencies. Additionally, the SDFO manages numerous small parcels of land between 40 and 360 acres in size, and many of these parcels are separated from other public lands by long distances and most are surrounded by private land. Roads that access these small parcels are often part of a network of roads traversing private land on ranches or lands administered by other agencies.

The SDFO manages five areas that contain more or less continuous parcels of public land—the Fort Meade Recreation Area ACEC (Meade County), the Exemption Area (Lawrence County), the Center of the Nation (Butte County and the Vale Area in southern Butte County) and the Two Rivers Area (Meade and Pennington counties). Of these, Fort Meade is the only SRMA. The other four continuous parcels of public land are included in the ERMA which encompasses the rest of the BLM land in the state. (See the discussion of Extensive Recreation Management Areas in the Recreation section.)

All locations within the planning area receive moderate OHV use during some time of the year. Presently, the public's OHVs are restricted to existing roads and trails and no allowances are made for off-road game retrieval. However, grazing lessees can go off-road to maintain fences and facilities and to perform livestock management activities.

The Fort Meade Recreation Area ACEC, located near Sturgis in southwestern Meade County, was designated an ACEC in 1996 to protect its unique cultural and historic resources (see the Special Designations section, ACECs, for a map of this area). Since the approval of the previous SD RMP (BLM 1986), no off-road driving of motor vehicles has been allowed other than by BLM employees and authorized users, or by law enforcement, rescue, or fire personnel in emergency situations. Motor vehicle traffic by the general public is restricted to: the Fort Meade Back Country Byway; graveled access roads and parking lots at the Alkali Creek Recreation Site, the Alkali Creek Horse Camp, and the Fort Meade Centennial Trailhead; the road to the Sturgis softball diamonds; and the access road to Fort Meade Reservoir.

The Exemption Area is located in Lawrence County near Lead and Deadwood (see Figure 2-2). The area was so named because it was exempted from the acts which established the Black Hills National Forests about a century ago. It encompasses some 5,100 acres in scattered tracts, mostly in mining claims. Some of these claims are contiguous, giving the BLM larger tracts of land. Since the mid-1990s, the Lead-Deadwood area has undergone a housing boom, with many of the old, privately owned mining claims and nearby parcels of agricultural or forest land subdivided into recreational cabins and ranchettes. The new owners tend to fence their property boundaries, causing the loss of numerous traditional hiking and OHV trails and also limiting physical access to the public lands for various recreational activities.

The Center of the Nation, located in northern Butte County and southern Harding County in the northwestern portion of the state, has the BLM's largest amount of contiguous or near-contiguous land in South Dakota (see Map 2-11). The SDGFP has enrolled a large amount of private land adjoining or near BLM into their "Walk-In Area" program (see details of this program on the SDGFP website at http://www.gfp.sd.gov). Most of the area's use is during the hunting season. OHV traffic by hunters is technically restricted to existing roads and trails, and portal signs are posted reminding users of that restriction. During BLM mapping of the area's road and trail network, no locations were noticeably damaged by OHV use. The terrain somewhat restricts the development of new trails, and soil types seriously limit off-road travel when they are saturated. The Center of the Nation has good north-south access, but limited roads and trails traverse the area in an east-west direction.

Two Rivers Area. Two Rivers is located near the confluence of the Belle Fourche and the Cheyenne rivers (Figure 3-20). The northern area is in Meade County and the southern area is in Pennington County, with the Cheyenne River forming part of the boundary between the counties. Although geographically close, physical access between the northern and southern portions is miles away except for some fords across the Cheyenne River. BLM-administered tracts adjoining the Belle Fourche River from the confluence of Whitewood Creek to its confluence with the Cheyenne River, and BLM land along the Cheyenne from that point to its confluence with the Missouri River were exchanged as part of the Homestake Settlement. Consequently, no BLM land adjoins the rivers in most of the area. Most public use of the Two Rivers area is during the hunting season. The southern area has slightly better public access, with poor access to the northern portion.

Vale Area. The SDFO manages a large block of public land east of Vale, South Dakota, in southern Butte County. This area is utilized by the public mostly during the hunting season, with reasonably good access to some of its outside boundaries but poor access into its interior.

Scattered Tracts of Public Land. The SDFO manages numerous small, scattered tracts of public land in northern Stanley County (Figure 3-21) and portions of Fall River and Custer counties (Figure 3-22). Those tracts with public access are utilized primarily during the hunting season. Other than grazing and some outfitting and guiding during hunting season, their use is incidental. This public land is not readily identifiable as being any different than the adjoining private lands and is utilized in the same way as the surrounding property. It is also visited by SDFO range and realty specialists during periodic compliance inspections.

Access by any means to scattered, isolated BLM tracts in the planning area can be difficult. While much of the discussion above focuses on specific areas, scattered tracts of BLM-administered public land are also present throughout the entire planning area. Many of these tracts are surrounded by private land and lack physical access by road or by section line. Even on legally accessible tracts, conflicts sometimes occur between the public and private landowners, especially during the hunting season. Some hunters claim private landowners are denying access, while landowners claim hunters do not know where the BLM-administered public land and/or legal access routes are located. Landowners have expressed concern to the BLM that hunters sometimes trespass on private land when they attempt to access public land or pursue game. The SDGFP has mitigated this situation somewhat by instituting walk-in areas for hunting access and providing maps of public hunting areas and roads that can be downloaded into GPS units (see the SDGFP website at http://www.gfp.sd.gov).

Facilities

Most of the SDFO facilities are located at the Fort Meade Recreation Area ACEC and consist of water systems, bridges, power and phone lines, structures, and site improvements. In the Exemption Area, three Homestake powder houses are located near Ruby Flats and portions of an aqueduct system which supplies the City of Lead with water. Facilities are described in detail in Appendix O.

Exemption Area BLM Photo

Figure 3-20
SDFO Two Rivers Area (Portions of Meade and Pennington Counties)

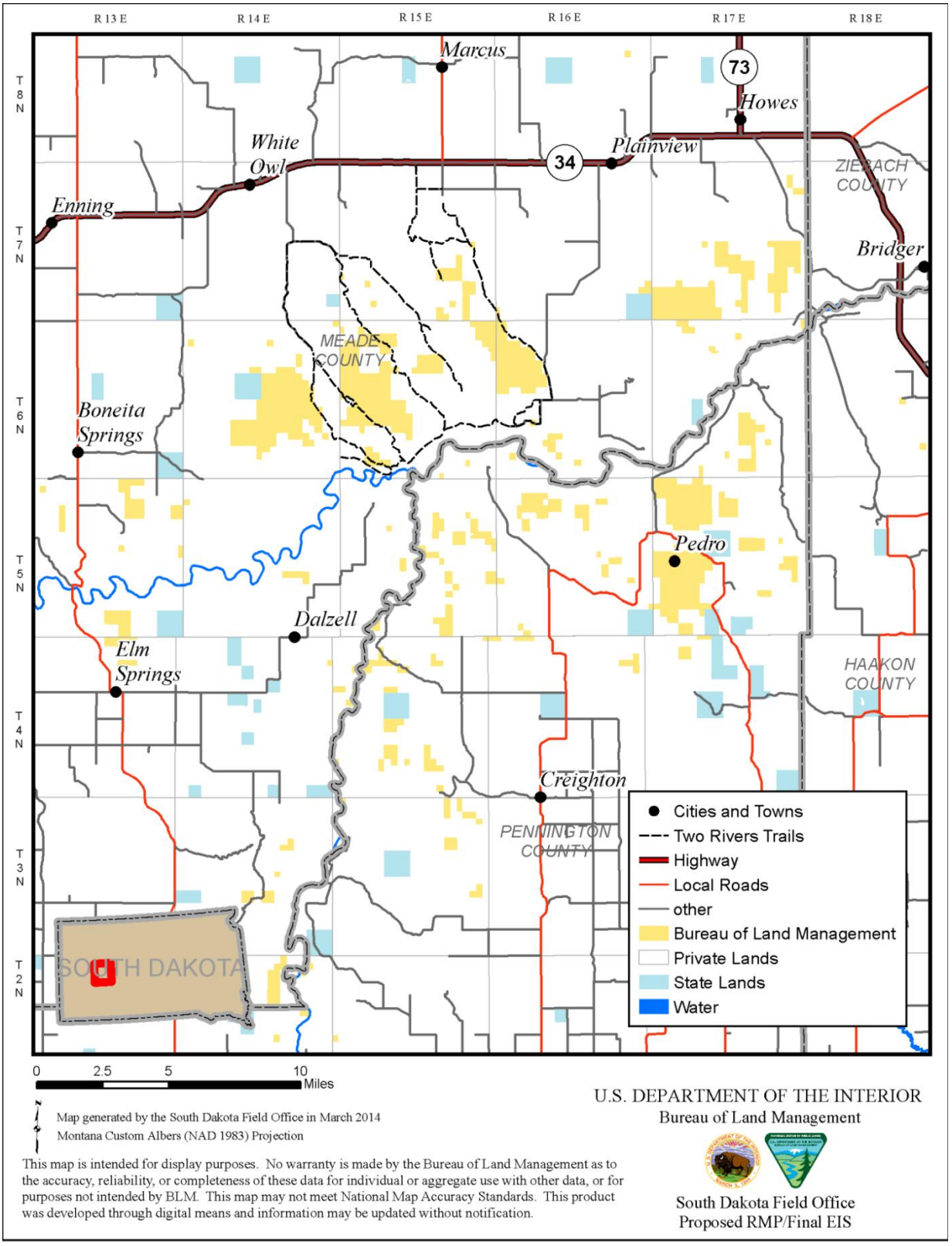


Figure 3-21
Northern Stanley County

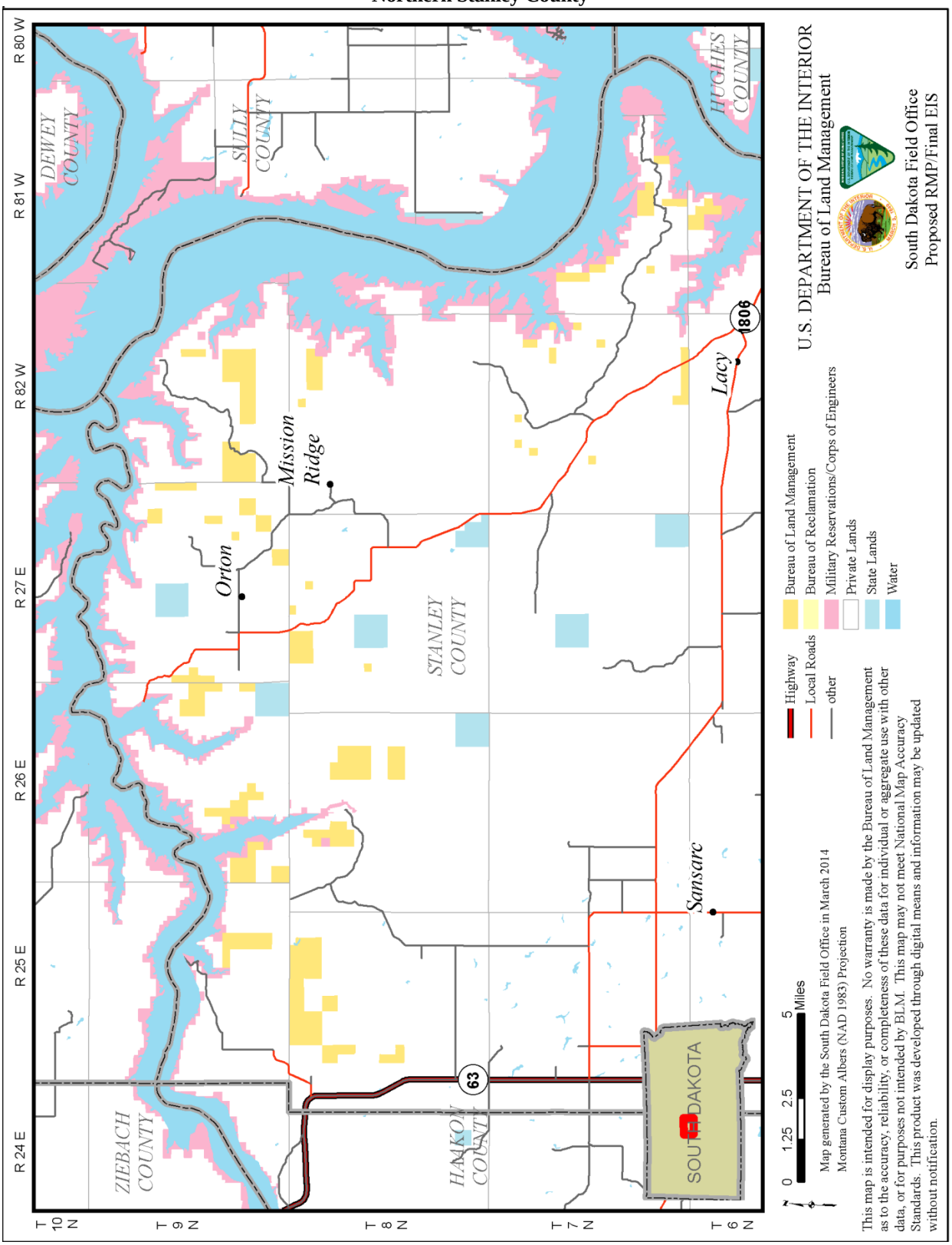
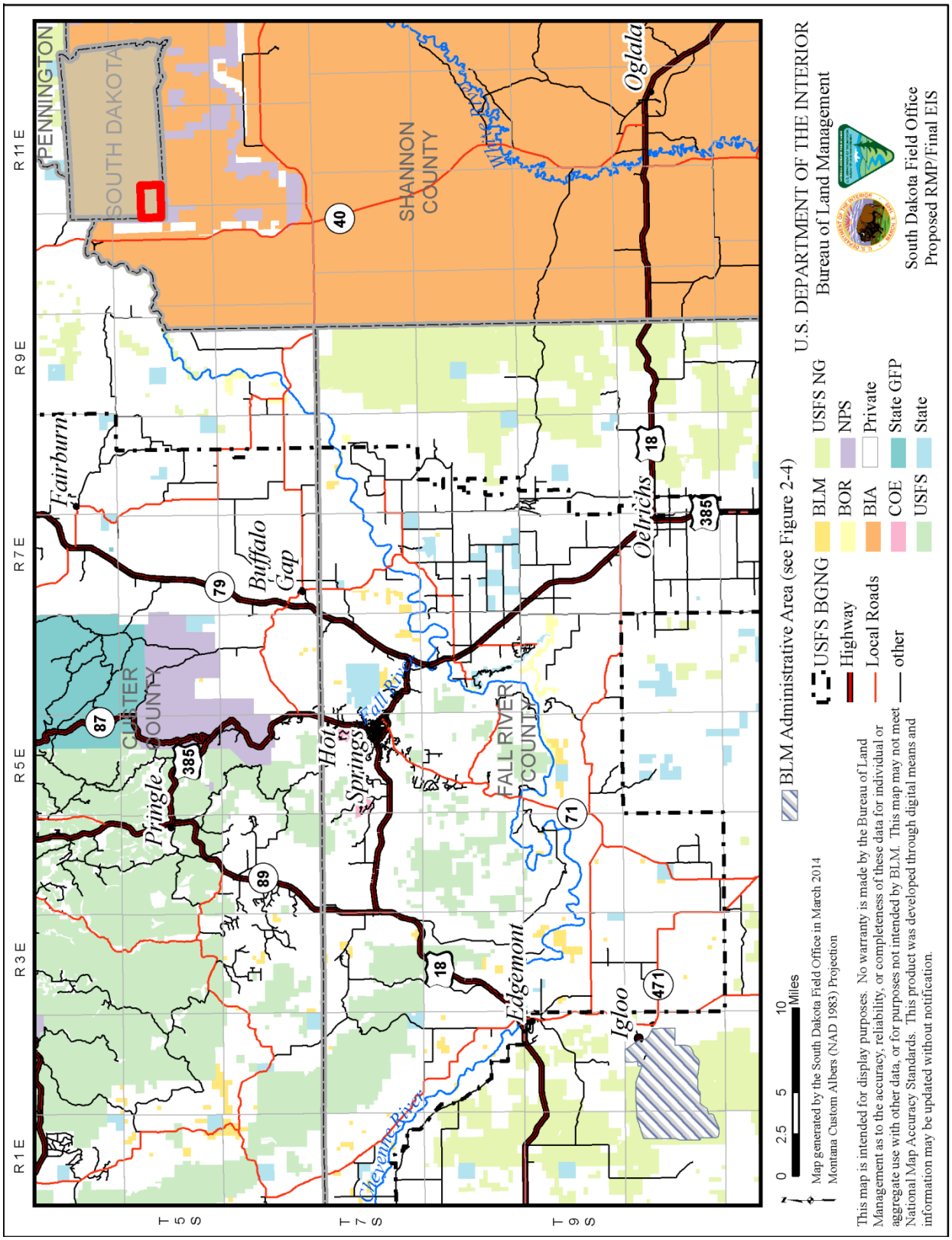


Figure 3-22
Southern Hills Public Land (Portions of Fall River and Custer Counties)



Social and Economic

Social Conditions

This section discusses the social conditions in the planning area, with a particular emphasis on the counties west of the Missouri River where most of the BLM-administered public lands and federal mineral estate are located. This discussion focuses on six counties: Butte, Harding, Meade, Pennington, Lawrence and Stanley. Data for the planning area as a whole and the State of South Dakota are included for comparison purposes.

Social Trends and Attitudes

This section focuses on social trends and attitudes that affect BLM land management. One trend is the increasing popularity of BLM land for recreation. A comprehensive report on recreation by Cordell et al. (1999) indicates demand in the Rocky Mountain West (which includes South Dakota) for recreation activities will increase substantially by the year 2020 with non-consumptive wildlife activities, sightseeing and visiting historic places having the greatest increases. Another trend is a concern to maintain access to the BLM-administered public land if access through private land is required to reach the BLM land. In addition, the loss of access to some private land, for the general public, is putting more pressure on the BLM land. These changes are linked to the pursuit of a quality recreation experience and occur for a variety of reasons: lands are purchased for recreation or other reasons and are closed to others; lands are leased to outfitters for exclusive use; and private land and roads are closed to avoid problems with safety, fire, fences, weeds, litter, and open gates.

Another trend that is occurring in the nation and South Dakota is the aging of the population. In 2009, 14.5 percent of the population in the planning area was 65 or older. The percentage of people 65 or older is actually increasing more rapidly in states like South Dakota because young people are more likely to leave for advanced education, military service and employment opportunities not available locally.

Changes in the management of BLM land are just one aspect of a broader debate on environmental and resource management that is occurring locally, nationally and globally. Social values for lands and natural resources can take many forms such as commodity, amenity, environmental quality, ecological, recreation, and spiritual. While the commodity value 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 et al. 2001).

In the rural West, in places where land use has been relatively unrestricted, concern is being expressed by some individuals and groups regarding the control and management of BLM land. People with these concerns feel that change in BLM land management is being driven by government officials and environmental advocacy groups who do not have a true understanding of the lands or the people living nearby who depend upon these lands for their livelihood and recreation. Of particular concern is the loss of current uses of the land such as mining, livestock grazing, and off-highway vehicle use. People with these concerns seek to balance what they consider to be environmental extremism with economic and human concerns. They may feel that local elected officials, who deal with their problems on a daily basis, are better equipped to make decisions about BLM land.

Population

In 2010, the population of South Dakota was 814,180, resulting in a population density of 10.7 people per square mile (compared to a national rate of 87.3). The 2010 population figure represented a 7.9 percent increase since 2000. The growth in the decade 2000 to 2010 was driven by growth in the two largest cities, Sioux Falls and Rapid City, in communities along interstate highways, and in counties with Indian Reservations (Copeland 2011).

In 2009, 14.5 percent of the South Dakota residents were 65 years and older compared to a national figure of 12.9 percent. Eighty-six percent of the 2010 South Dakota population was white, and 9 percent was American Indian. In the years 2005-2009, 89 percent (of persons over 25) were high school graduates (compared to a figure of 85 percent for the country as a whole).

Table 3-38 presents population data for the 10 counties where the social planning area is located. These counties are all located west of the Missouri River; very little public land is located east of the river. The population in these 10 counties totaled about 185,000 and comprised about 23 percent of South Dakota's total population in 2010. The total population of the planning area grew by about 5 percent between 2000 and 2010 with the more urban areas and areas along the interstate experiencing growth and the more rural areas maintaining or losing population. Population in the individual counties ranges from about 1,250 in Harding County to more than 100,000 in Pennington County. The average percent of the population 65 and over was 17.7, compared to the state figure of 14.5.

The largest community in the planning area is Rapid City in Pennington County; it had a 2010 population of nearly 68,000. Five other communities in the planning area had 2010 populations above 3,000: Spearfish (10,494), Sturgis (6,627), Belle Fourche (5,594), Hot Springs (3,711), and Lead (3,124). Including Rapid City, all of these communities are located in or near the Black Hills area. Three of the counties in the planning area (Haakon, Harding, and Perkins) have no communities with a population of more than 800; these are the more rural counties away from the Black Hills. The current population trends are expected to continue in the near future, with counties with larger populations gaining and the more rural counties losing population.

Butte County

Butte County, which is located directly north of the Black Hills in western South Dakota, contains more than 50 percent of the planning area's public lands and nearly one-third of the federal mineral estate. Belle Fourche, the county seat, is the location of the BLM's South Dakota Field Office. The county population was 10,110 in 2010, and Belle Fourche's population was 5,594 the same year. The county population grew 11 percent between 2000 and 2010 while Belle Fourche's population grew by over 20 percent. Of Butte County's total acres (1,439,000), 10 percent are BLM-administered public lands and 37 percent are BLM-administered federal mineral estate.

In 2007, Butte County had 584 farms and ranches, with 51 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches declined by 9 percent between 2002 and 2007 while the percent of principal operators whose primary occupation was farming declined by 20 percent. The amount of land in farms and ranches declined by 10 percent while the size of the average operation declined by 2 percent to 1,953 acres. Butte County has over 50 percent of the BLM AUMS in the planning area and is dependent upon the BLM for 8 percent of its grazing AUMs. Other uses of BLM-administered lands in Butte County include bentonite mining, oil and gas exploration and development, greater sage-grouse habitat, big game wintering areas, and hunting and other recreation activities.

Meade County

Meade County, located directly northeast of the Black Hills in western South Dakota, is home to the Fort Meade Recreation Area and the annual Sturgis Motorcycle Rally. The county contains about 14 percent of the planning area's public lands and about 16 percent of the federal mineral estate. The county population was 25,434 in 2010, and Sturgis, the county seat's population, was 6,627 the same year. The county population grew 5 percent between 2000 and 2010 while Sturgis's population grew 3 percent. Of Meade County's total acres (2,541,000), less than 2 percent are BLM-administered public lands and 12 percent are BLM-administered federal mineral estate.

In 2007, Meade County had 879 farms and ranches, with 59 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches declined by 2 percent between 2002 and 2007 while the percent of principal operators whose primary occupation was farming declined by 14 percent. The amount of land in farms and ranches declined by less than 1 percent while the size of the average operation increased by less than 1 percent to 2,513 acres. Meade County has about 15 percent of the BLM AUMs in the planning area and is dependent upon the BLM for 2 percent of its grazing AUMs. Other uses of BLM-administered lands in Meade County include hunting and other recreation activities, big game wintering areas, and timber production.

Table 3-38												
Demographic Information for the Planning Area Counties												
	Butte	***Custer***	***Fall River***	***Haakon***	***Harding***	***Lawrence***	***Meade***	***Pennington***	***Perkins***	***Stanley***	***Planning Area***	***State of South Dakota***
2010 Population[1]	10,110	8,216	7,094	1,937	1,255	24,079	25,434	100,948	2,982	2,966	185,021	814,180
% Change (2000-2010)[1]	11.2	12.9	-4.8	-11.8	-7.2	10.5	4.9	14	-11.3	7	4.9	7.9
Persons Per Square Mile (2010)[1]	4.5	5.3	4.1	1.1	0.5	27.3	7.3	31.9	1	2.1	8.5	10.7
Net Migration 2000-2009[1]	218	709	247	-360	-279	1,273	-1,733	5,116	-393	-172	4626	13,367
% Age 65 & Over (2009)[1]	14.5	20.3	25.5	22.7	14.4	16.2	11.8	13.9	23.2	14.4	17.7	14.5
% HS Grad; Persons 25 & over (2005-2009)[1]	88.1	91.2	87.1	86.9	89.5	92.7	92.8	91.3	81.2	90.1	89.1	88.8
BLM-Admin. Public Land (Acres)	144,641	3,693	7,205	2,178	30,261	5,184	38,997	16,088	7,973	15,922	272,142	274,345
BLM-Admin. Federal Mineral Estate (Acres)	536,606	68,140	60,532	46,111	377,328	7,038	276,774	82,177	76,346	111,833	1,642,855	1,715,677
Environmental Justice Information for Planning Area Counties, 2013												
Race Alone[2]												
White	94.4%	93.2%	88.2%	93.3%	95.6%	93.6%	91.3%	83.5%	96.9%	88.3%	87.5%	85.9%
Black or African American	0.8%	0.7%	1.2%	0.8%	0.6%	1.3%	2.0%	1.7%	0.3%	0.8%	1.5%	1.9%
American Indian and Alaska Native	2.0%	3.4%	7.0%	2.2%	1.8%	2.3%	2.9%	9.9%	1.5%	8.4%	6.8%	8.9%
Asian	0.3%	0.6%	0.6%	0.5%	0.2%	0.8%	0.9%	1.2%	0.3%	0.2%	1.0%	1.2%
Native Hawaiian and Other Pacific Islander	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%

Two or More Races[2]	2.5%	2.0%	2.9%	3.2%	1.9%	2.0%	2.8%	3.6%	1.0%	2.4%	3.0%	2.1%
Hispanic[2]	3.5%	2.9%	3.3%	1.3%	2.5%	3.4%	4.0%	4.6%	1.1%	1.4%	4.1%	3.4%
Total Minority[3]	8.4%	9.3%	14.3%	7.8%	6.3%	9.2%	12.0%	19.6%	4.0%	12.9%	15.4%	16.7%
Poverty Percent, All Ages[4]	14.3%	10.8%	14.6%	12.2%	11.7%	14.9%	10.6%	15.4%	14.4%	8.8%	na	14.0%

Source: [1] http://quickfacts.census.gov/qfd/index.html (Accessed August 3, 2011)

[2] U.S. Census Bureau 2014a

[3] Total minority population refers to the part of the total population which is not classified as Non-Hispanic White Only by the U.S. Census Bureau. Calculated using U.S. Census Bureau 2014a.

[4] U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program, 2014

Harding County

Harding County, located in the northwest corner of South Dakota adjacent to the borders of Montana and North Dakota, contains 11 percent of the planning area's public lands and 22 percent of the federal mineral estate. The county population was 1,255 in 2010 and Buffalo, the county seat's population, was 330 in the same year. The county population declined 7 percent between 2000 and 2010 while Buffalo's population declined by 13 percent. Of Harding County's total acres (1,709,000), less than 2 percent are BLM-administered public land and 22 percent are BLM-administered federal mineral estate.

In 2007, Harding County had 252 farms and ranches, with 75 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches increased by 13 percent between 2002 and 2007 while the percent of principal operators whose primary occupation was farming declined by 16 percent. The amount of land in farms and ranches declined by 5 percent while the size of the average operation decreased by 16 percent to 6,334 acres. Harding County has 15 percent of the BLM AUMS in the planning area and is dependent upon the BLM for 3 percent of its grazing AUMs. Other uses of BLM-administered lands in Harding County include greater sage-grouse habitat, big game wintering areas, hunting and other recreation activities, and oil and gas exploration and development. Harding County is located directly south of the area in North Dakota where extensive oil and gas development is occurring and there is some evidence that this extensive level of development may extend into South Dakota in the future.

Pennington County

Pennington County is located directly east of the Black Hills and is the home to Rapid City, the major trade and service center in western North Dakota and also the county seat. This county contains 6 percent of the planning area's public lands and 5 percent of the federal mineral estate. The county population was 100,948 in 2010 and Rapid City's population was 67,969 in the same year. The county population increased 14 percent between 2000 and 2010 while Rapid City's population increased by the same percent. Of Pennington County's total acres (1,777,000), less than 1 percent are BLM-administered public land and 5 percent are BLM-administered federal mineral estate.

In 2007, Pennington County had 655 farms and ranches, with 64 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches decreased by 6 percent between 2002 and 2007 while the percent of principal operators whose primary occupation was farming remained about the same. The amount of land in farms and ranches declined by 2 percent while the size of the average operation increased by 4 percent to 1,809 acres. Pennington County has 8 percent of the BLM AUMS in the planning area and is dependent upon the BLM for 2 percent of its grazing AUMs. Other uses of BLM-administered lands in Pennington County include hunting.

Lawrence County

Lawrence County is located in the western part of South Dakota and is home to the northern part of the Black Hills and the Exemption Area, which is BLM-administered land surrounded by the Black Hills National Forest. This county contains 2 percent of the planning area's public lands and less than 1 percent of the federal mineral estate. The county population was 24,079 in 2010, which represented a 10.5 percent increase from 2000. The three larger communities in Lawrence County are Lead, the county seat with a 2010 population of 3,124, Deadwood with a population of 1,270, and Spearfish, with a population of 10,494. Lead and Spearfish gained population during the decade 2000 to 2010 (+3 percent and +22 percent, respectively), while Deadwood lost population (-8 percent). Of Lawrence County's total acres (512,026), 1 percent are BLM-administered lands and a little over 1 percent are BLM-administered federal mineral estate.

In 2007, Lawrence County had 239 farms and ranches, with 55 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches increased by 26 percent between 2002 and 2007 while the percent of principal operators whose primary occupation was farming decreased by 12 percent. The amount of land in farms and ranches declined by 5 percent while the size of the average operation declined by 25 percent to 444 acres. Lawrence County has less than 1 percent of the BLM AUMS in the planning area and is dependent upon the BLM for less than 1 percent of its grazing AUMs. Other uses of BLM-administered land in Lawrence County include timber production, mining, and recreation.

Stanley County

Stanley County is located in central South Dakota west of the Missouri River and directly across the river from the state capital, Pierre. Fort Pierre, the county seat, is part of the Pierre urban area. The county contains 6 percent of the planning area's public lands and 7 percent of the federal mineral estate. The county population was 2,966 in 2010 and Fort Pierre, had a population of 2,079 during the same year. The county population increased 7 percent between 2000 and 2010 while Fort Pierre's population increased by 4 percent. Of Stanley County's total acres (923,699), nearly 2 percent are BLM-administered public lands and 12 percent are BLM-administered federal mineral estate.

In 2007, Stanley County had 165 farms and ranches, with 54 percent of the principal operators identifying farming and ranching as their primary occupation (USDA 2011). The number of farms and ranches remained the same between 2002 and 2007 while the percent of principal operators whose primary occupation was farming declined by 18 percent. The amount of land in farms and ranches increased by 6 percent while the size of the average operation increased by 7 percent to 5,582 acres. Stanley County has about 6 percent of the BLM AUMS in the planning area and is dependent upon the BLM for 4 percent of its grazing AUMs. Other uses of BLM-administered lands in Stanley County include hunting and other recreation activities.

Potentially Affected Groups and Individuals

Discussions of affected groups and individuals are included in the Social Conditions section above to aid in assessing the social effects of SDFO planning decisions in the upcoming RMP/EIS. Groups being assessed are: ranchers/ livestock permittees; small rural communities; recreationists, groups and individuals who prioritize resource protection, groups and individuals who prioritize resource use, and American Indians. These groups are not mutually exclusive and examples of households that fit into many categories are likely to be present.

In many cases, social effects are described in terms of effects to quality of life, which could include the amount and quality of available resources such as recreation opportunities and resolution of problems related to resource activities. Other less tangible beliefs that could affect quality of life include individuals having a sense of control over the decisions that affect their future. Individuals also want a sense of control over having the federal government act in ways that consider all stakeholders' needs.

Ranchers/Livestock Permittees

Ranching is an important part of the history, culture, and economy of the planning area. The BLM issues leases to 437 operators within the planning area. About 10 percent of the farms/ranches in the planning area hold BLM grazing leases with cattle being the most prevalent class of livestock. Of the six counties with the most acreage in BLM grazing leases, the percentage of principal operators for whom farming/ranching was the principal occupation ranged from 51 percent in Butte County to 75 percent in Harding County (USDA 2011).

Many challenges face ranchers today, including changes in federal regulations; economic issues; estate, financial, and business planning; and varying goals of family members in the business. Permittees may face increasingly stressful social situations as they try to balance their traditional lifestyles with demands from government agencies and other public 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 broken 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, especially in land with scenic values, the recreational value of property has become more important than the agricultural value. The tradition of ranching being a multi-generational livelihood is also changing with family ranches being sold or leased when an estate is settled rather than being operated by the next generation.

Comments offered by ranchers/permittees during the scoping period include: the need to maintain grazing leases so the ranching culture can continue, the importance of ranching to local economics and communities, the potential change in criteria for allotment management plan designation, maintaining motorized access to administer the grazing lease, and concern about plant or animal habitat reintroduction programs and their potential effect on livestock. Some also mentioned that interspersed parcels are a source of conflict with recreationists and land exchanges would be a way of resolving these

conflicts. Overall, many ranchers wanted to continue the current management situation. Examples of comments received during the scoping process for the Draft RMP/EIS are:

> *"The customs and culture of western SD should be taken into consideration in any alternative that would affect grazing use."*

> *"Most BLM lands are intermingled with private land, which makes the management of them different than in most other areas of the US. Consequently, management and coordination with permittees and adjacent private landowners is essential."*

Recreationists

Recreation is a component of many lifestyles in the planning area and is an important element of the overall quality of life for many residents. In addition to local recreation use, tourists from all over the U.S. come to this area, with outdoor recreation an important component of many of these visits. Overall, public lands in the planning area support some type of recreational activity during all times of the year, with the greatest amount of recreational opportunities and visitation occurring in the Fort Meade Recreation Area. Recreationists are diverse groups of people, and changes in recreation management can affect the people who engage in the various activities differently.

The types of comments offered by recreationists during the scoping period include: provide greater access to public lands for hunting, fishing and other recreation purposes, provide better OHV access across BLM lands to connect with National Forest lands in the Lead-Deadwood area, use land exchanges to resolve concerns regarding hunter access and conflicts between recreationists and landowners. Conflicts between different types of recreationists have also been identified as an increasing problem. Examples of comments received during the scoping process are:

> *"Work with OHV groups to identify areas with old quarries, rolling draws, or ravines that are marginally suitable for other management practices, but would provide great recreational opportunities."*

> *"How can BLM best contribute to "non-motorized" backcountry recreation opportunities in the state? Could additional road closures help to create large areas without motorized use?"*

> *"Provide improved access for rock hounds and loosen current daily collection limits."*

Groups and Individuals who Prioritize Resource Protection

People living within and outside the planning area, along with a variety of local and regional organizations, have shown interest in this RMP. Concerns include protecting wildlife habitat, riparian areas, and water; the effect of travel management policies on wildlife and wildlife diversity; invasion of non-native plants; habitat fragmentation; protection of the visual environment; and examination of areas to determine if they warrant special protection. Examples of comments received during the scoping process are:

> *"We urge the BLM in its RMP revision process to conduct a comprehensive survey of all BLM lands in SD with an eye toward designating additional ACECs (and NCAs and ONAs) if appropriate sites exist."*

> *"The aesthetic value of the viewsheds, the context of historic structures, and biodiversity of natural landscapes must be preserved."*

Groups and Individuals who Prioritize Resource Use

Groups and individuals, including some local residents, expressed support for multiple use and a concern about potential limitations to oil and gas and other types of development within the planning area. Examples of comments received during scoping from groups or individuals who prioritize resource use include:

> *"Energy development including grants for easements for power lines should be encouraged."*

"The BLM has a significant timber resource that can provide wood products for the local timber industry and would encourage your agency to manage the timber resource in a sustainable way by basing the harvest on the amount of annual growth."

Small Rural Communities

Small rural communities can be tied to the BLM and other public lands in a variety of ways. Local businesses and governments depend upon BLM employees to support businesses and public services. Use of BLM-managed lands for recreation activities, livestock grazing, minerals/energy development, and other activities provide economic and leisure time opportunities.

The types of comments received for this RMP include: manage fuels in the Exemption Area and assist local residents with fire and fuels management, consider the effects on the local surface users and/or grazing permittees when leasing oil and gas, concern about the public's misuse of private land near public land during recreation activities, and recognize the importance of farming and ranching to western South Dakota's social and economic fabric. Examples of comments received during scoping are:

"The counties tax base is directly related to the value of the ranches that have grazing allotments. The economic well-being of the entire county depends on the ranch customs and cultures that have developed for generations."

"On the normally dry prairies of the county fire is a constant danger. No policy should restrict the prevention or control of fires on BLM land."

"Efforts to control noxious weeds need to be in coordination with the local county weed department to insure a successful program."

"Multiple use principles must be considered in the management plan revision. Rangelands should be managed to maximize productivity, which will benefit both wildlife and livestock. The revised plan should provide for outdoor recreation and human occupancy and use."

"Wildlife species need to be managed in a way that protects local citizens to pursue their historic and customary livelihoods without fear of economically devastating property losses."

American Indians

Five American Indian Reservations are located in western South Dakota (see Table 3-39): Pine Ridge (Oglala Sioux), Standing Rock (Dakota and Lakota Sioux), Cheyenne River (Cheyenne River Sioux), Rosebud (Rosebud Sioux), and the Lower Brule (Lower Brule Sioux). In addition, many other tribes in eastern South Dakota and adjacent states have aboriginal territories that overlap the planning area. Indian traditionalists have maintained connections to places containing edible and medicinal plants, rock art, grave sites, and places used for tree platform "burials," mineral and plant products used in ritual or for paints, and vision quest stations. Tribal members are also interested in visiting the sites of battles, old trading posts, and ghost towns to learn more about these aspects of their history. Areas of particular interest to various tribes on or adjacent to BLM lands in the study include Bear Butte and the Black Hills.

The types of comments received from the tribes during tribal consultation and scoping were: assist American Indians and the State of South Dakota to preserve the land and viewshed adjacent to Bear Butte, consider land exchanges or withdrawals for the benefit of historic property preservation and protection, and protect the Black Hills because anything that affects the Black Hills affects the tribes. Protection of areas near sacred sites and sacred sites in general need to be protected. Examples of comments received during scoping are:

"The land is sacred to the Oglala Lakota people. It has archeological, cultural and historic significance. Exploratory mining would destroy the established beneficial use of land on the chance that uranium might be found. Water is also a scarce and precious resource in the Black Hills."

"Protect Bear Butte from encroachment wherever you can, including sound pollution and anything that will affect the viewshed from the mountain."

Table 3-39
Demographic Information for Indian Reservations and the Counties Where They are Located in Western South Dakota (2010)

	Total Reservation Population 2010	***% American Indian (Alone) Population 2010***
Cheyenne River Reservation (Dewey and Zieback Counties)	8,088	75.0%
Lower Brule Reservation (Lyman and Stanley Counties)	1,504	88.9%
Pine Ridge Reservation (Bennett, Jackson and Shannon Counties)	18,830	88.0%
Rosebud Reservation (Millette and Todd Counties)	10,869*	88.5%*
Standing Rock Reservation (Corson County, SD and Sioux County, ND)	8,217	75.5%
State of South Dakota	814,180	8.8%

*Source: U.S. Census Bureau 2010, * U.S. Census Bureau 2012*

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" (Executive Order 12989).

Minority populations as defined by Council on Environmental Quality (CEQ) guidance under the National Environmental Policy Act (CEQ 1997) include individuals in the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. A minority population is identified where "(a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater…" (CEQ 1997). Additionally, "[a] minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds" (CEQ 1997). Low-income populations are determined by the U.S. Census Bureau based upon poverty thresholds developed every year.

U.S. Census data is used to determine whether the populations residing in the study area constitute an "environmental justice population" through meeting either of the following criteria:

- At least one-half of the population is of minority or low-income status; or
- The percentage of population that is of minority or low-income status is at least 10 percentage points higher than for the entire State of South Dakota.

Data for the identification of low-income is from the U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE). The SAIPE program produces yearly single year poverty estimates for states, counties, and school districts and is considered the most accurate for these geographic scales, especially for areas with populations of 65,000 or less (U.S. Census 2014b). Minority populations are identified using the U.S. Census Population Estimates program which provides

estimates for the resident population by age, sex, race, and Hispanic origin at the national, state and county scales. Total minority population refers to that part of the total population which is not classified as Non-Hispanic White Only by the U.S. Census Bureau. By using this definition of minority population, the percentage is inclusive of Hispanics and multiple race categories and any other minority single race categories. This definition is most inclusive of populations that may be considered as a minority population under EO 12898. Estimates from SAIPE and the Population Estimates program are used in federal funding allocations.

Environmental Justice

Involves the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to development, implementation, and enforcement of environmental laws, regulations, and policies. (BLM H-1601-1).

For this planning effort the identification of environmental justice populations is conducted at the county level due to the large geographic area. Table 3-38 provides minority and poverty percentages for the counties of the planning area and for the State of South Dakota. While all of the counties show both minority and low-income populations, none of the counties in the planning area meet the criteria discussed above for having environmental justice populations (minority or low-income). Table 3-39 highlights the high percentages of American Indian alone populations on reservations in comparison to the State of South Dakota in 2010; however only Lower Brule Reservation is located partially in the planning area counties. This is what explains the difference in numbers and why none of the planning area counties meet the environmental justice criteria described above. Given the high percentage of American Indians across Western South Dakota and as discussed under Tribal Interests, the SDFO has lands within historical/traditional cultural use areas. This does indicate the need for outreach and coordination or consultation with American Indians which is discussed below as well as in Chapter 5.

Tribal Interests

BLM coordination or consultation with Native Americans, as it pertains to tribal interests, treaty rights and trust responsibilities, is conducted in accordance with the following direction:

- Bureau Manual Handbook H-8120-1 – Guidelines for Conducting Tribal Consultation (Transmitted 12/03/04).
- 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; April 29, 1994).
- Order No. 3175 – Departmental Responsibilities for Indian Trust Resources (Section 2 of Reorganization Plan No. 3 of 1950 – 64 Stat. 1262; November 8, 1993).
- Secretarial Order 3317 and the Department of Interior Policy on Consultation with Indian Tribes.

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 (Article 6, Clause 2). Treaty rights are not gifts or grants from the United States, but are 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 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 Indian tribes because of these treaties. As a federal land managing agency, the BLM has the responsibility to identify and consider potential impacts of BLM plans, projects, programs, or activities on Indian trust resources (see Glossary). When planning any proposed project or action, the BLM must ensure that all anticipated effects on 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 South Dakota, including the lands now managed by the South Dakota Field Office, 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 time immemorial. Numerous places within the planning area historically were utilized by native groups for natural resources 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 SDFO are within the historical/traditional culture use area of the following tribes:

- Cheyenne River Sioux
- Cheyenne-Arapaho Tribes of Oklahoma
- Crow Creek Sioux Tribe
- Crow Nation
- Flandreau Santee Sioux Tribe
- Fort Belknap Assiniboine and Gros Ventre
- Fort Peck Assiniboine and Sioux Tribes
- Lower Brule Sioux Tribe
- Lower Sioux Indian Community
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Omaha Tribe of Nebraska
- Rosebud Sioux Tribe
- Santee Sioux Tribe of Nebraska
- Shoshone Tribe (Eastern)
- Sisseton-Wahpeton Sioux Tribe
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Three Affiliated Tribes (Mandan, Hidatsa, Arikara Nation)
- Turtle Mountain Band of Chippewa Indians of North Dakota
- Upper Sioux Indian Community
- White Earth Band of Minnesota Chippewa Indians
- White River or Kaviawach Utes
- Yankton Sioux Tribe of South Dakota

The SDFO 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 Native American groups. The traditional value that is of primary concern to land managers is a respect for the land and places where American Indian ancestors once lived.

Issues exist outside the scope of the SDFO RMP/EIS that continue to be tribal concerns. These include treaty rights, legislation, the Black Hills "Settlement" (see upcoming discussion of the various Fort Laramie treaties), and Article VI of the U.S. Constitution. Issues that are within the scope of the BLM's legal obligations include: land valuation, American and American Indian values, traditional cultural properties, sacred and burial sites, cumulative effects of undertakings, and others.

Following is the background for some of these issues:

Article VI of the U.S. Constitution is cited by the tribes. In part, it says:

> *This Constitution and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, anything in the Constitution or Laws of any State to the Contrary notwithstanding. The Senators and Representatives before mentioned, and the Members of the several State Legislatures, and all executive and judicial Officers, both of the United States and of the several States, shall be bound by Oath or Affirmation, to support this Constitution; but no religious test shall ever be required as a Qualification to any Office or public Trust under the United States.*

Article VI is frequently mentioned by Tribal people during consultation between the BLM and the tribes. Tribal members cite this as affirmation that their treaties are supreme law of the land and that treaties supersede the decisions of courts, even the U.S. Supreme Court. Thus, the Black Hills Settlement discussed below is invalid to many tribal people.

The Black Hills of South Dakota are sacred to the Great Sioux Nation (Sioux) and many other Plains Tribes. The Sioux recognize their land base in accordance with the Fort Laramie Treaty of 1851, in which Sioux lands extended from the Big Horn Mountains in the west, east to eastern Wisconsin; from Canada to the north and south to the Republican River in present-day Kansas. Under the Fort Laramie Treaty of 1868, the U.S. government pledged that the Sioux Reservation, including the Black Hills, would be "set apart for the absolute and undisturbed use and occupation" of the Sioux and that no treaty for the cession of any part of the reservation would be valid against the Sioux unless executed and signed by at least three-fourths of the adult male Sioux population.

The 1851 reservation was reduced in the 1868 treaty to the Big Horn Mountains on the west, eastward to the Missouri River, from the Heart River in present-day North Dakota south to the Platte River in present-day Nebraska. Subsequently, in 1876 an "agreement" signed by only ten percent of the adult male Sioux population provided that the Sioux would relinquish their rights to the Black Hills and their rights to hunt in the unceded territories in exchange for subsistence rations for as long as they would be needed.

In 1877, Congress passed the 1877 Act implementing this "agreement" and thus, in effect, abrogated the Fort Laramie Treaty. The Sioux regarded the 1877 Act as a breach of the 1868 Fort Laramie Treaty and have made many attempts at reclaiming the Black Hills.

In 1980, the U.S. Supreme Court characterized the 1877 Act as a taking in exercise of Congress' "power of eminent domain" over Indian property. Accordingly, the court held that the Sioux were entitled to an award of interest on the principal sum of $17.1 million (the fair market value of the Black Hills as of 1877), dating from 1877 (United States vs. Sioux Nation of Indians, 448 U.S. 371, 1980). The Sioux did not accept the award and continue to work for the return of the Black Hills area to their people. The accrued interest on the award now totals more than $530 million. Therefore, any action affecting federal lands in the Black Hills proposed by the RMP would be considered a significant action to the tribes. Any proposed federal actions within the Black Hills would also require consideration by the Greater Sioux Nation and other affected tribes.

Economics

Certain defining features of every area influence and shape the nature of local economic activity. Principal among these for the BLM planning area are the amount of BLM-managed surface and mineral estate, size of the area's population, the presence of or proximity to large cities or regional population centers, types of longstanding industries such as mining and agriculture, and predominant land and water features and unique area amenities.

Within the planning area, the BLM administers about 274,000 acres of BLM public land surface and approximately 1.7 million acres of federal mineral estate in 37 counties (Table 1-1). Most of these lands and minerals are located in the western and central part of the state. Ten counties have more than 1,000 surface acres administered by the BLM. The BLM surface acres in these 10 counties make up 99 percent of the BLM surface in South Dakota. These counties also have about 96 percent of the BLM managed mineral estate in South Dakota. From the 37 counties in the SDFO the economic analysis area was narrowed down to eleven key counties: Butte, Custer, Fall River, Haakon, Harding, Hughes, Lawrence, Meade, Pennington, Perkins, and Stanley counties. The economic analysis area includes the ten counties that make up 99 percent of the BLM surface in South Dakota and 96 percent of the BLM managed mineral estate. Additionally, Hughes County is included due to the economic ties it has with the other ten counties.

Economic Characteristics and Trends

The following summary economic trend information for the local economy is followed by a description of the key land uses in the planning area that could be affected by BLM management actions. These are: 1) oil and gas leasing, exploration, development, and production; 2) travel, tourism and recreation; 3) livestock grazing and production; 4) government operations; 5) ecosystem restoration; and 6) other mineral exploration, mining, and reclamation. BLM lands provide areas for hunting and fishing, hiking and camping, and general sightseeing, as well as providing important habitat for area fish and wildlife on BLM lands.

Potential economic effects associated with this proposed RMP include changes in employment, income, public revenues, economic dependency, economic stability, and quality of life. The information contained in this section is presented to help clarify economic issues, describe relevant economic trends, and provide context for potential changes to economic indicators that may be predicted in the environmental analysis in Chapter 4.

Table 3-40: Selected Economic Statistics					
County/Area	*Employment*	*Area (Sq. Miles)*	*Number of Sectors*	*Average Income per Household*	*Total Personal Income ($ Millions)*
Butte	4,604	2,249	119	$67,245	$268
Custer	4,449	1,558	111	$78,546	$273
Fall River	3,500	1,740	109	$70,925	$230
Haakon	1,333	1,813	76	$130,984	$98
Harding	983	2,681	61	$80,538	$37
Hughes	13,878	741	126	$98,902	$713
Lawrence	15,552	800	159	$74,674	$767
Meade	14,936	3,471	151	$93,771	$877
Pennington	64,449	2,776	206	$83,360	$3,534
Perkins	1,913	2,872	82	$71,101	$93
Stanley	2,064	1,443	77	$106,488	$129
Total	**127,661**	**22,134**	**243**	**$83,904**	**$7,024**

Source: IMPLAN 2009.

BLM Land and Mineral Uses that Affect the Local Economy

The effect of the BLM on local economic activity and conditions is related to BLM land use decisions and associated land uses. Table 3-41 identifies the major population and business centers and BLM land and mineral uses in each county. Hughes County is also added to the table and considered in the local economy because of the presence of Pierre, the South Dakota State Capital and a major business and population center in central South Dakota.

Table 3-41: BLM-Administered Lands (SD RMP Planning Area)					
County	**BLM Surface Acres**	**BLM % of County**	**BLM Mineral Estate Acres**	**BLM Mineral Estate % of County**	**Major Population Centers and BLM Land/Mineral Uses**
Butte	144,641	10	536,606	37	Belle Fourche, livestock grazing, recreation use, bentonite mining
Custer	3,693	<1	68,140	7	Custer, recreation use, livestock grazing, timber
Fall River	7,205	<1	60,532	5	Hot Springs, recreation use, livestock grazing, uranium exploration, Rights-Of-Way
Haakon	2,178	<1	46,111	4	Livestock grazing, recreation use
Harding	30,261	1.7	377,328	22	Livestock grazing, oil/gas exploration and production, recreation use
Hughes	2	<1	500	<1	Pierre
Lawrence	5,184	1	7,038	1	Spearfish, Lead, Deadwood, timber, recreation, mining, livestock grazing
Meade	38,997	1.7	276,774	12	Sturgis, livestock grazing, recreation use, timber production
Pennington	16,088	<1	82,177	5	Rapid City, recreation use, livestock grazing,
Perkins	7,973	<1	76,346	4	Lemmon, livestock grazing, recreation use
Stanley	15,922	1.7	111,833	12	Ft. Pierre, livestock grazing, recreation use
Other	2,203	<1	72,792	<1	
Total	**274,345**		**1,715,677**		

Livestock Grazing and Production

Ranching is an important part of the history, culture, and economy of the planning area. Grazing is authorized on BLM lands for the purpose of fostering economic development for private ranchers and ranching communities by providing ranchers access to additional forage (GAO, Sept. 2005). The major contribution of BLM to the area's livestock industry is largely through providing grazing lands. Livestock grazing on BLM lands is authorized on an annual basis. Livestock grazing based on allocated AUMs varies from year to year due to factors such as drought, wildfire, transfer of grazing permits, financial limitations on operators, and implementation of grazing management to improve range conditions. Between 1999 and 2009, BLM grazing averaged 62,270 AUMs annually (Table 3-42).

Table 3-42
Average Annual Authorized Livestock Grazing Use (AUMs)
Billing Years 1999-2009

	Section 15*	***Cattle***	***Horses***	***Sheep/Goats***
11-Year Average	62,270	53,307	175	8,788

Source: Range Administration System, 1999-2009
*Section 15 of the Taylor Grazing Act concerns issuing grazing *leases* on public lands *outside* the original grazing district boundaries.

The BLM issues grazing leases to 437 livestock operators within the planning area. It is common for an individual/ operation to hold several leases. About 10 percent of the farms/ranches in the planning area hold BLM grazing leases.

Cattle are the most prevalent class of livestock, although sheep and horses also graze BLM land in the planning area. Livestock operations are primarily operated as cow/calf pairs. Most calves are born in late winter through spring on private lands. Calves have historically been weaned in the fall and most leave the region to be grown out and/or fed in other parts of the U.S. At weaning, most cows have been taken to winter pasture where they remain until they calve the following year. About 78 percent of the cattle and 71 percent of the sheep are marketed (2007 Census of Agriculture).

Roughly 72 percent of all agricultural products marketed are livestock related and the BLM provides less than one percent of the total forage requirements for the livestock inventory within the planning area. By assuming a direct relationship between the percent of agricultural products that are livestock-related and the percent of agricultural related employment that is associated with livestock production, it is estimated that BLM livestock grazing contributes about 177 total jobs to the local economy. This estimate does not include the contribution of family labor which may be as much as 38 percent of the total direct labor contribution to livestock operations (David Taylor, University of Wyoming 2010). It is estimated that about $1.5 million in total wage and proprietor's income is related to BLM livestock grazing within the planning area (IMPLAN 2012).

The amount of BLM grazing land and the dependency of local livestock operators on BLM forage varies among operators. Livestock grazing on BLM land involves livestock operators who have Section 15 grazing leases (grazing on public lands outside of grazing districts). On public domain lands, 50 percent of revenues from Section 15 grazing fees are distributed to the state and counties. The 2013 grazing fee is $1.35 per AUM for all areas with BLM grazing leases except the grazing lease for 1,823 AUMs on the Fort Meade Recreational Area. Based on 2013 grazing fees, average annual revenues are almost $148,000 and the average annual funds distributed to counties from grazing receipts (1999-2009) are almost $74,000.

The grazing fee the BLM charges is calculated by a formula which incorporates private land lease rates, beef cattle price index computed by National Agriculture Statistics Service (NASS), and a prices paid index which is also computed by NASS and reflects livestock production costs and is generally lower than fees charged by states, and private ranchers who set fees to obtain the market value of forage. The formula used to calculate the BLM grazing fee incorporates the ranchers' ability to pay and does not recover the agency's expenditures or capture the fair market value of forage. Livestock operations in the planning area often involve large areas of land, and ranchers depend on a mix of private and federal lands to graze cattle seasonally. None of the livestock operations are wholly dependent on forage coming from public lands. To qualify for a grazing lease on public land an operator must have land and the capability to accommodate their livestock for a

specified period of time on private land owned or controlled (base property) adjacent or apart from the BLM land (43 CFR 4110). Often BLM livestock operations depend heavily on forage from BLM lands during a specific season; i.e., many operators graze BLM land in the spring through fall for five to seven months and winter their livestock on base property.

BLM forage may be particularly valuable to livestock producers because the grazing fees are very favorable and it is often available during a critical period of the year when forage on private hay fields and meadows is being grown to provide forage for the winter. The 2009 BLM grazing fee ($1.35/AUM) is considerably lower than the 2009 statewide average of $22.90 per AUM (South Dakota Annual Statistics Bulletin, National Agricultural Statistics Service, 2010). If the BLM were to charge a market-based fee, the price would likely not equal private or state fees because of factors such as range productivity services provided by the landowner and access to the land (GAO, September 2005).

Access to BLM and Forest Service grazing may be important to area livestock producers even though additional management costs are often incurred to use these lands. According to a 2005 GAO report on livestock grazing, "fees charged by private ranchers and state land agencies are higher than the BLM and Forest Service fees because, generally, ranchers and state agencies seek to generate grazing revenues by charging a price that represents market value for that land and/or the services provided."

Mineral Development and Production

Mining sector activities include uranium, gold, and bentonite mining, and oil and natural gas production. Gold mining occurred around Lead and Deadwood for more than 100 years and once provided a major economic stimulus to the region and employed hundreds of people. However, since the closure of the Homestake Mine for mineral production in 2002, the number of mining related jobs has declined. Aggregated mining sectors (industry sectors 20-30) support approximately 1,360 total jobs and $46 million in labor income within the planning area (IMPLAN 2012). About 54 percent of the jobs and 18 percent of the labor income in the mining sectors are associated with oil and gas related activities. The amounts of federal minerals and the dependency of local economies on that production vary among the counties.

Nature of the Oil and Gas Industry in the Planning Area

Only three counties (Harding, Custer, and Fall River) currently have oil and/or gas production. The vast majority of the production comes from Harding County. In 2008, there were 151 producing oil wells and 84 producing gas wells. Average wellhead prices paid in 2012 were $90.58/bbl for oil and $5.16/mcf for natural gas. The average cost of drilling and equipping a well in South Dakota was $3,982,887 (oil), $627,705 (gas), and $1,768,799 (dry) (IPAA 2011).

Oil and natural gas development and production account for almost 740 jobs and $8.1 million in employee compensation and proprietor income (IMPLAN 2012). Local oil and gas production also supports jobs in the natural gas pipeline transmission industry. Local contractors, as well as regional firms from North Dakota and Wyoming also provide contract services to local oil and gas fields.

Local economic effects of leasing federal minerals for oil and gas exploration, development, and production are influenced by the amount of leased acres, number of wells drilled, and estimated levels of production. These activities influence local employment, income, and public revenues (indicators of economic impacts).

Oil and Gas Leases

In June 2014, 80,743 acres of BLM-managed federal minerals in the SDFO were leased for oil and gas. Annual lease rental is paid on 44,262 acres that are not held by production. Estimated annual average lease bonus and rental revenue to the federal government was about $108,787. Lease rents were not paid on 36,481 acres that were held by production. Instead, royalties are paid on oil and gas production from these leases.

Federal oil and gas leases generate a one-time lease bid as well as annual rents. The minimum lease bid is $2.00 per acre; however, bonus bids averaged $3.88 per acre on federal leases issued between 2005 and 2010. Lease rental is $1.50 per acre per year for the first five years and $2.00 per acre per year thereafter. Typically, oil and gas leases expire after 10 years unless held by production. Annual lease rentals continue until one or more wells are drilled that result in production and associated royalties. Within the SDFO, about 45 percent of the federal leased acres are held by production. Forty-nine percent of these federal leasing revenues are distributed to the state. For revenues received from public domain lands, the State of South Dakota distributes the revenues to public schools or other public educational institutions within the counties in which the minerals were produced (SD statute 13-14-3.1). Currently, the federal government collects an annual average of about $109,000 in lease bids and rent; of which an estimated $53,000 is distributed to the state/local governments.

Oil and Gas Production

Between 2005 and 2010, production from federal minerals in the SDFO averaged 176,444 barrels of oil and 206,353 mcf of natural gas (ONRR 2011). Federal oil and gas production in South Dakota is subject to production taxes or royalties. On public domain minerals, these federal oil and gas royalties generally equal 12.5 percent of the value of production (43 CFR 3103.3.1). Forty-nine percent of these royalties are also distributed to the state. In South Dakota, all of the royalty revenues that the state receives are redistributed to the counties of production to support public education. Estimated average annual federal royalty revenues are about $2.1 million; of which about $1 million were distributed to the state and counties.

Local Economic Contribution of Oil and Gas Activities

The economic contribution to a local economy is measured by estimating the employment and labor income generated by 1) payments to counties associated with the leasing and rent of federal oil and gas, 2) local royalty payments associated with production of federal oil and gas, and 3) economic activity generated from drilling and associated activities. Activities related to oil and gas leasing, exploration, development, and production form a basic industry that brings money into the state and region and creates jobs in other sectors. Extraction of oil and natural gas (North American Industry Classification System [NAICS] sector 20), drilling oil and gas wells (NAICS sector 28), and support activities for oil and gas operations (NAICS sector 29) supported an estimated 740 total jobs and $8.1 million in total employee compensation and proprietor's income in the local economy (IMPLAN 2012).

Total federal revenues from federal oil and gas leasing, rents, and royalty payments average an estimated $2.2 million annually. Federal revenues distributed to the State of South Dakota average an estimated $1.1 million per year. The state redistributes all of this to the public school districts and other public educational institutions within the South Dakota counties with federal leases and production (South Dakota statute 13-14-3.1).

Locatable Mineral Activities

Locatable mineral claims have been filed for bentonite, gold, and uranium. There is also potential for cement grade limestone. Bentonite is the federal locatable mineral most likely to contribute to economic activity in the planning area. Currently, the only bentonite mining in South Dakota occurs in Butte County. In 2008, 114,000 tons were mined in Butte County, South Dakota (SD Dept. of Environment and Natural Resources 2010). It is estimated that about 17 percent (19,380 tons) of the bentonite that is mined is federal minerals. The average 2012 price of bentonite in South Dakota was $62 per ton (USGS, Minerals Information 2014). No federal royalty revenues based on federal locatable mineral production are collected or distributed to the state or local governments.

No uranium mining or production occurs on federal minerals at this time. However, Powertech (USA) Inc. completed drilling exploration in Custer and Fall River counties under its initial uranium exploration permit issued in 2007. The technical economic model parameters used in the preliminary assessment included a market price of $65.00/lb. and an

estimated production of 8,407,000 pounds over the life of the mine. Approximately 42 percent of the project area would be unpatented mining claims administered by the BLM.

Currently, no unpatented mining claims are being mined for gold; however, it is anticipated that up to 50 acres of BLM-administered mineral estate could be impacted during the life of this plan.

A cement grade limestone project is planned to begin about 15 years into the planning period; however, the project is not expected to reach BLM surface or federal minerals until 30 years after the start of the plan.

In 2012, it was estimated that about 139 jobs and $12.2 million in wage and proprietor's income within the local economy were associated with industrial sectors 23 and 24 (mining copper, nickel, lead, zinc, gold, silver, and other metals). The operating mines involve relatively small amounts of federal minerals and little of the employment and related income would be related to federal mineral mining.

No other locatable mineral production occurs on federal minerals (unpatented mining claims) at this time. Nor is any other federal mineral production anticipated in the reasonably foreseeable future.

Salable Mineral Activities

No sand/gravel production has occurred on BLM lands/minerals since the 1970s and no applications are pending.

Recreation Use

The economic influence of recreation use is related to the amount of recreation use on BLM lands and related local expenditures for goods and services such as gasoline, lodging, meals, and supplies. To understand the local/regional economic influence of recreation use, it is important to understand what recreation activities occur on BLM lands because local/regional expenditures vary depending on the type of activity, whether the recreation use is from local residents or non-local residents, and whether the activity involves overnight stays.

Local/regional expenditures related to recreation use support local/regional employment and labor income (standard economic indicators). Generally, employment related to recreation and tourism tends to be seasonal and relatively low paid, with a high portion of the labor force self-employed. The recreation opportunities available in the planning area play an important role in the quality of life of many local residents, and also attract visitors from elsewhere in the state and region. The BLM lands in the planning area received an estimated annual average 186,903 recreation visits between 2003 and 2007 (BLM, RMIS 2003-2007). Major recreation activities on BLM lands are hunting and fishing and driving for pleasure. Recreation and tourism is not classified or measured as a standard industrial category. Components of recreation and tourism activities are instead captured in other industrial sectors, primarily the retail sales and services sectors.

It is assumed that day use and overnight use in the planning area would be similar to that found in the Dakota Prairie National Grasslands. Table 3-43 displays the estimated trip type segment shares of recreation use on BLM lands in South Dakota. It is estimated that about 60 percent of all the recreation use is day use by local residents. Average party size is 2.4 visitors (White and Stynes 2010). Table 3-44 shows the estimated average spending per party trip for all recreation related activities.

Table 3-43
Trip Type Segment Shares for Use in Activity Spending Analysis

Non-Local Day Use	*Non-Local Overnight (on and off BLM)*	*Local Day Use*	*Local Overnight (on and off BLM)*	*Non-Primary*
7%	16%	50%	15%	12%

Source: White and Stynes 2010, Table A-3

Table 3-44
Non-Local/Local Spending Averages, All Activities, $ Per Party Per Trip

Management Unit	*Non-local Day Trips*	*Non-local Overnight Trips*	*Local Day Trips*	*Local Overnight Trips*
Dakota Prairie (Average)	65	366	34	177

Source: White and Stynes 2010, Table 3

Average spending for day and overnight recreation use on the nearby Dakota Prairie Grasslands is assumed to be representative of daily recreation expenditures on BLM lands within the planning area. Using these data as a proxy of expenditures per recreation visit on BLM lands in the planning area, it is estimated that average daily expenditures per visitor are $46.60 and annual total expenditures are $8.7 million.

These expenditures would be split among the following economic sectors: lodging, restaurants, groceries, gas/oil, other transportation, activities, admissions/fees, and souvenirs.

Government revenues received from the recreation program are associated with recreation use permits issued. Average annual revenues received are $2,900. None of these revenues are distributed to the state or counties.

The willingness to pay for recreation opportunities would represent an estimated annual average consumer surplus of $11.0 million.

Timber Management

Timber harvest from BLM lands within the planning area averaged 2,667 CCF over the last 10 years. Most of this (1,648 CCF) was related to stewardship projects; of which, 1,030 CCF was sawtimber volume and 658 CCF was biomass volume. Timber sales averaged 799 CCF; firewood sales averaged 24 CCF; and sawtimber averaged 195 CCF per year. Christmas tree sales average three trees per year and about 400 posts/poles are harvested annually.

Current adjusted base period price of ponderosa pine that is used in appraising timber sales in the Black Hills zone is $41.94 per CCF (Forest Service, Region 2, Appraisal Bulletin, October 2010). Four percent of the revenue from timber sales on public domain goes to the state, 76 percent to the Bureau of Reclamation, and 20 percent to the U.S. Treasury. Distribution of revenue from salvage sales is different, in that 4 percent of revenue from timber sales on public domain goes to the state, and 96 percent goes to the BLM.

Lands and Realty Actions

The BLM issues or renews rights-of-way for infrastructure in support of economic activities within the planning area. The BLM receives rental revenues for federal rights-of-way. Types of rights-of-way include powerlines, telecommunication lines, roads/highways, communication sites, oil and gas pipelines, water pipelines/facilities, material sites, water facilities, and railroads. If the right-of-way is issued under FLPMA authority, none of the rents are shared with the state or local governments. If the right-of-way is issued under the Mineral Leasing Act Authority, 50 percent of rents are shared with the state, which distributes the revenue it receives to the appropriate counties for education purposes.

In FY 2010, the BLM received $1,748 in rights-of-way rents. No rents were reported as Mineral Leasing Act rights-of-way.

Currently, no rights-of-way exist for wind energy development on BLM-administered lands and no wind farms are present adjacent to BLM-administered lands. However, the BLM has received one application and it is anticipated that some development will occur on public lands over the life of the plan. Analysis of anticipated impacts is included in chapter 4.

Direct BLM Contributions to Area Economic Activity

BLM operations and management in South Dakota make a direct contribution to economic activity by employing people who reside in the state and by expending dollars on other non-personnel needs. Management of BLM lands and resources is

carried out by professional and administrative employees who are stationed in the BLM office in Belle Fourche. In Fiscal Year 2010, the office had positions for 15 permanent employees and 10 other than permanent. In Fiscal Year 2010 BLM spent $1.523 million for labor and $1.424 million on operations.

Ecosystem Restoration: Some land uses/activities such as weed treatments and hazardous fuels treatments are paid for by the BLM and are grouped together as ecosystem restoration. Activities associated with ecosystem restoration include treatment of invasive species and pest management and hazardous fuels treatments. Economic effects of invasive species and their treatments are related to their influence on range productivity, wildfire risk, and attractiveness for recreation, and ultimately, how these impacts affect local employment, income, and government revenues. Direct and indirect impacts from treatments of invasive species vary based on the species being treated and the type of treatment used. The average BLM per acre cost of weed treatments in 2009 was $181. About 27 percent of the acres treated are done by BLM personnel and 73 percent is done by the counties through county assistance agreements. However, these assistance agreements for weed treatments should already be accounted for in BLM non-salary expenditures and would not have additional impacts.

The cost of wildfire suppression within the planning area depends on the number and size of fires. Most wildfires are controlled in the initial attack, when they are relatively small. However, weather conditions, terrain, vegetation, and proximity to populated areas all contribute to the cost of fire suppression.

Revenue Disbursement: Average annual payments to South Dakota counties related to BLM management are displayed in Table 3-45. The largest amount of payments to counties is related to mineral leasing, rents, and royalties. Payment in lieu of taxes (PILT) is another major source of public revenues. PILT payments are made to counties to compensate for federal lands that are exempt from local property taxes. Payment amounts are based on a complex formula that considers, among other things, revenue sharing from the previous year, county population, and acreage of a county in federal ownership. These payments are not evenly distributed among the counties. Generally more of these payments go to counties with more BLM lands/minerals and uses.

Table 3-45
Average Annual Payments to Counties from BLM-Related Uses (11-County Area)

*Grazing Fee**	*Mineral Payments***	*BLM Portion of 2010 PILT****	*Timber Sales*	*Total*
$73,809	$1,097,439	$569,647	$327	$1,741,222

Sources:
*Average annual (1999-2009) authorized AUMs (Section 15 revenues plus Ft. Meade revenues)
**Average annual production x 2012 commodity prices
***USDI Fiscal Year 2010 Payments In Lieu of Taxes

Total BLM Economic Contributions: Activities occurring on or associated with BLM land and mineral resource uses supported an estimated average annual 453 jobs and $10.8 million in labor income within the planning area (FEAST/ IMPLAN 2012). BLM land/minerals use-related jobs and income amounted to less than one percent of area totals. BLM-related employment and income by major program area are displayed in Table 3-46.

Table 3-46
BLM Resource-Related Employment and Income by Major Program Area

Resource/Program Area	*Resource-Related Jobs*	*Resource-Related Income ($1,000)*
Grazing	177	$1,513
Minerals	115	$3,337
Recreation Use	76	$2,006
Timber	15	$515
Payments to States/Counties	18	$742
BLM Expenditures	52	$2,678
Total Resource Management	453	$10,792
BLM as a Percent of 11-County Area Economy	<1%	<1%

Source: IMPLAN 2012

Public Safety

Continuity of Operations

To maintain essential operations, communication, and accountability during bad weather or disasters, the SDFO maintains a Continuity of Operations Plan. This plan provides direction for emergency operations, alternate work sites, crisis management, employee accountability, law enforcement, coordination with other BLM Offices and other agencies, and other procedures for short-term (72 hours) and long-term events.

Abandoned Mine Lands

Within the planning area, numerous hard rock mines in the Exemption Area and lands mined for bentonite as well as other small areas mined for sand, gravel, and uranium have been designated "Abandoned Mine Lands" (AMLs; see Glossary). These AMLs will be documented and placed in the BLM GIS system, and as the SDFO identifies AMLs having chemical or physical hazards, remedies will be undertaken. Public safety, bat habitat, hazardous materials, and protection of cultural values are key considerations when managing mine openings, adits and shafts. If mine features are to be closed for public safety, bat gates or similar structures are installed to preserve good bat habitat. If a mine feature is not good habitat, or is unsafe for closing, bats may be excluded from the feature prior to the permanent closing of the feature. Consideration is given to the preservation of important mine openings as cultural resources, where feasible. Table 2-6 and Appendix D provide BLM guidance for mitigation of the hazards associated with these AMLs. Site-specific project level environmental review is conducted prior to initiation of all AML projects.

Debris Flows

Landslides and debris and mud flows are types of mass wasting events. Landslides, which are masses of rock, earth, or debris moving down a slope, occur in all U.S. states and territories. Landslides may be small or large and slow or rapid; they are activated by storms, earthquakes, volcanic eruptions, fires, alternate freezing or thawing, and steepening of slopes by erosion or human modification. Intense, short bursts of rain may create particularly dangerous conditions causing landslides or debris and mud flows, especially after longer periods of heavy rainfall and damp weather.

Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." They can flow rapidly, striking with little or no warning at avalanche speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars, and other materials. The major hazard to human life from debris flows is from burial or impact by boulders and other debris. Buildings and other property in the path of a debris

flow can be buried, smashed, or carried away. Because of their relatively high density and viscosity, debris flows can move and even carry away vehicles and other objects as large as bridges and locomotives.

Debris flows and landslide problems can be caused by land mismanagement, particularly in mountain and canyon regions. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Land use zoning, professional inspections, and proper design can minimize many landslide, mudflow, and debris flow problems. Damaged land should be replanted as soon as possible since erosion caused by loss of ground cover can lead to flash flooding and additional landslides.
To avoid the effects of a debris flow, it is very important to not construct buildings or roads near steep slopes, close to mountain edges, near drainageways, or natural erosion valleys. Maintaining good plant cover on slopes will help prevent landslides.

Flash floods, which have been the most deadly natural disasters in South Dakota, occur most frequently during May and June. They are caused by stationary or slow-moving thunderstorms that produce heavy rain over a small area. The Black Hills are especially vulnerable to flash floods, where steep terrain and narrow canyons can funnel heavy rain into small creeks and dry ravines, turning them into raging walls of water.

In the planning area, the debris flows that are the most often seen have resulted from heavy rainfalls after intense forest fires. These flows, which carried boulders, cobbles, soil material, trees, charcoal, and other woody debris down the slopes, have caused extremely destructive events.

Lawrence County, located in the west-central portion of the state in the northern section of the Black Hills, has the conditions most likely to result in debris flows. Approximately 60 percent of the land area in this county has a slope greater than 18 percent. In July 2002 and as a result of the Grizzly Gulch fire in the Deadwood area, Hospital Gulch was denuded of vegetation due to the fire's high temperature. Within weeks of the fire, a very fast, heavy rainfall occurred in the same area, causing a debris flow to occur down 30 percent gradient slopes. The flow was blocked by a house, which quickly filled with water and debris; another rainfall occurred a few days later, pushing the house off of its foundation and destroying it. The house was eventually removed, and a drainageway was placed in the existing lot.

Rivers undercutting, destabilizing and steepening banks, as well as wave action in lakes, can cause a landslide or debris flow at any time, but most likely these events occur after a rainfall. Slumps of steep lands containing shale or bentonite are common after heavy rainfall or during heavy snowpack melting.

Rarely, talus or scree slopes can be taken beyond their tenuous stability and shift downslope. Large and even moderate earthquakes are extremely uncommon in South Dakota, but a moderate earthquake could trigger widespread shifting of steep, unstable lands.

All areas with the potential for debris flows will be evaluated by an experienced Burned Area Response team to evaluate the need for ES&R treatments. These treatments may include projects to encourage water infiltration, mulching, erosion control, slope stabilization, slope and bank armoring, water diversions, drainage structure upgrades, and early warning systems.

Also see the "Fire Management and Ecology" section for a discussion of Fire Safety.

Hazardous Materials

Two Minuteman Missile sites (nuclear missile installations) were located on public lands in the planning area. Environmental site assessments conducted by the U.S. Air Force indicated a low likelihood of waste problems remaining on the missile sites. However, the missile sites could still have some small potential to contain unknown waste problems.

The Black Hills Ordnance Depot was officially designated in February 1942 in Fall River County. The site consisted of 21,095 acres, and was utilized for long-term storage of ammunition. In August 1962, the site was renamed the Black Hills Army Depot (BHAD). The facility was developed with industrial storage, administrative buildings, housing, and related support facilities and utilities. The BHAD was used for the receipt, storage, maintenance, inspection, testing, restoration, issuance and shipping of ammunition, propellants, and chemical toxics, the unpacking and functional packing of small arms

ammunition, and the demilitarization of unsafe, obsolete and surplus ammunition, chemical ammunition, ammunition components, chemical toxics and general supplies. In 1967, the Black Hills Army Depot was closed and in 1968 was declared surplus by the Department of the Army. The City of Edgemont, South Dakota, purchased all land within the boundary fence and the remainder of the former site, including mineral rights, was transferred to the United States. Currently, the entire site is used for livestock grazing. Area residents have expressed safety concerns to the BLM about the improper storage of hazardous materials at this site. Some residents are concerned about the potential release of hazardous materials as a result of oil and gas development activities. BHAD poses safety concerns because of the burning and burial of hazardous materials that occurred between WWII and the Vietnam Era. In 1981, a study conducted by Ecology and Environment, Inc. determined that a change in land use which would generate direct human contact, such as housing or crops for human consumption, should be avoided (SD DENR 2012b at http://denr.sd.gov/des/gw/Superfund/Federal_Facilities.aspx). The BHAD has required Superfund actions in the past; it is a designated Superfund site. Additional studies of the hazards in this area are currently being conducted by the Department of Defense.

The Minerals section of this chapter discusses hazardous material as it relates to mineral exploration and development.

The BLM works with South Dakota DENR and other Federal agencies as required to reduce the potential adverse impacts of hazardous materials.

Standard Operating Procedures for Hazardous Materials

For any needed hazardous material management within the planning area, the BLM would use Standard Operating Procedures.

For hazardous material management in the planning area the BLM would:

- Minimize threats and reduce risks to the public and environment from hazardous materials.
- Comply with all appropriate laws and regulations regarding hazardous materials.
- Disposal of hazardous materials on public lands would not be permitted.
- When the use or storage of hazardous materials is authorized (i.e., in mining operations or other types of commercial activities), apply special stipulations to comply with appropriate laws, regulations, and policies.
- If hazardous materials incidents occur on public land, use Standard Operating Procedures to respond.
- Conduct cleanups and reclamation in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (see Glossary) and the NEPA decision.
- Promote and support the appropriate use and recycling of hazardous materials in public facilities and on public land to prevent or minimize the generation and disposal of hazardous wastes.
- Minimize and remediate hazardous materials spills or incidents.
- Conduct environmental site assessments for land acquisitions, land disposals, and (if applicable) for ROWs. Authorize and manage land uses to reduce the occurrence and severity of hazardous materials incidences on public land.
- Assess the level of risk at hazard sites and conduct remediation at the highest priority sites that are the greatest risks to the public and to the environment.
- Prevent pollutants such as flammable liquids and lubricants from entering streams by storing them outside of riparian areas, having a spill prevention and control plan, and not allowing refueling within riparian areas (except for permitted mining activities, fire suppression activities, reclamation work, and chainsaw refueling).

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