CHAPTER 3

AFFECTED ENVIRONMENT

INTRODUCTION

This chapter contains a description of the existing physical, biological, and socioeconomic characteristics of the planning area that would be affected by the alternatives described in Chapter 2. Environmental components that would not be affected or that are not important to the resolution of planning issues are not covered in detail. For descriptions of the public land parcels, see Appendix 4 and Maps 3-9.

Much of this information has been summarized from reports and other material on file in the Pinedale Field Office. Information which is available upon request includes a list of threatened, endangered, and candidate plant and animal species to be covered in the RMP EIS, a geologic map of the planning area, monthly weather station data, vegetative treatment guidelines for the control of noxious weeds, and copies of the judgments and stipulations entered in the court cases settling ownership of the parcels in the 1970s and 1980s.

The following resources are not present in the planning area and are not addressed in this RMP EIS: Prime and Unique Farmlands, Wilderness, Wild Horses, and Forestry (marketable timber). In addition, no areas have been determined to meet the criteria for designation as Areas of Critical Environmental Concern or other special management area designation.

AFFECTED RESOURCES

Climate and Air Quality

Climate and Meteorology

The climate of the Snake River area is classified as mid-latitude highland or alpine (Trewartha & Horn 1980; Martner 1986). Alpine climate is characterized by large varieties of local climates, depending on elevation and slope exposure, but is generally a similar and cooler version of nearby lowland climate.

Weather data for the Snake River planning area is available from a weather station located in Jackson. The Jackson weather station is at an elevation of 6,330 feet and is within the Snake River planning area.

Diurnal (morning to night) and seasonal (summer to winter) ranges in temperature are greater in valleys than on slopes (Martner 1986). Mean annual temperature is 39 degrees F. in Jackson. Summer highs are usually in the 70's and low 80's. Winter lows are generally in the single digits but may reach the minus teens (Western Regional Climate Center).

Mean annual precipitation is 16 inches in Jackson. Annual precipitation ranges from 8 inches in drought years to as much as 25 inches in wet years. Monthly precipitation is generally 1 to 1.5 inches throughout the year (Western Regional Climate Center). Total winter snowfall averages

about 4 feet, with most snow occurring from November through March. Mean monthly winter snowfall ranges from 10 to 20 inches (Western Regional Climate Center).

Wind speed and direction are highly variable due to the effect of local topography in the Snake River area. Annual average wind speed in Jackson is 6 miles per hour, and annual wind direction is generally from the northwest, west or southwest (Martner 1986). In mountainous areas like the Snake River area, local topography can strongly affect wind direction, particularly at night and under low wind speed conditions.

Air Quality

Pollutant Concentrations

Pollutant concentration refers to the mass of pollutant present in the air, and can be reported in units of micrograms per cubic meter ($\mu g/m^3$) or parts per billion (ppb) (see Table 3-1). Air quality in the planning area is considered excellent; however, current and complete criteria air pollutant concentration data for the Snake River area are not available. The State of Wyoming has used monitoring and modeling to determine that the Snake River region is in compliance with Wyoming and federal standards. Air quality regulations for the state of Wyoming are listed in Appendix 3.

TABLE 3-1
CONCENTRATIONS OF CRITERIA AIR POLLUTANTS

Pollutant	Averaging Time	Monitored & Modeled Concentration ($\mu g/m^3$)	Percent NAAQS (%)	Percent WAAQS (%)
Carbon Monoxide (CO)	8 hour	1500	15	15
	1 hour	3500	9	9
Nitrogen Dioxide (NO_2)	Annual	9	9	9
Sulfur Dioxide (SO_2)	Annual	9	11	15
	24 hour	43	12	17
	3 hour	132	10	19
Ozone (O_3)	8 hour	139	89	89
	1 hour	144	61	
Particulate Matter (PM_{10})	Annual	12	24	24
	24 hour	20	13	13
Fine Particulate Matter ($PM_{2.5}$)	Annual	6	40	
	24 hour	10	15	

Carbon Monoxide

Carbon monoxide (CO) data were collected in Colorado in conjunction with the proposed oil shale development in the 1980s. Because carbon monoxide data are generally collected only in urban areas where automobile traffic levels are high, recent data are often unavailable for rural areas.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) data were collected at the Carbon County Underground Coal Gasification site in 1994 and 1995. Although more recent NO_2 data are not available, monitoring of other nitrogen-containing pollutants shows concentrations at Pinedale and Yellowstone National Park (YNP) of nitric acid (HNO_3), nitrate (NO_3), and particulate ammonium (NH_4) are very low and are not increasing over time.

The Clean Air Status and Trends Network (CASTNet) has measured concentrations of nitric acid, nitrate and ammonium, as well as ozone, sulfur dioxide and sulfate, in the United States since the late 1980s. There are three CASTNet stations in Wyoming: Centennial, Yellowstone National Park, and Pinedale. CASTNet data are available for Pinedale from 1989 through 1999, and for Yellowstone National Park from 1997 through 1999.

Mean annual concentrations of nitric acid (HNO_3) are less than 0.45 ppb in Pinedale and less than 0.3 ppb in YNP. Nitric acid concentrations typically range from 0.02 to 0.3 ppb in remote areas, and range from 3 to 50 ppb in polluted areas (Seinfeld 1986).

Mean annual concentrations of nitrate (NO_3) are less than 0.2 ppb in YNP. These concentrations are typical for remote areas. Polluted urban areas show mean annual nitrate concentrations of 1 ppb or more (Stern 1973).

Mean annual concentrations of ammonium (NH_4) are less than 0.3 ppb in YNP. Ammonium concentrations in remote areas are typically about 0.3 ppb, and about 1.5 ppb in urban areas (Stern 1973).

The Wyoming Air Resources Monitoring System (WARMS) has measured concentrations of nitrate and particulate ammonium, as well as sulfur dioxide and particulate sulfate, in Wyoming since 1999. There are five WARMS stations in Wyoming: Centennial, Buffalo, Sheridan, Newcastle, and Pinedale. Weekly concentrations of nitrate (NO_3) are below 1.5 $\mu g/m^3$, and concentrations of ammonium (NH_4) are below 0.5 $\mu g/m^3$ at Pinedale. Mean annual concentrations in remote areas are 0.5 $\mu g/m^3$ for nitrate (NO_3) and 0.2 $\mu g/m^3$ for ammonium (NH_4).

Because the chemistry of nitrogen-containing pollutants is very complex, it would be inappropriate to infer nitrogen dioxide (NO_2) concentrations from concentrations of nitric acid (HNO_3), nitrate (NO_3), and ammonium (NH_4). But it would be unlikely that high nitrogen dioxide (NO_2) concentrations would occur with low concentrations of other nitrogen-based pollutants.

Sulfur Dioxide

Sulfur dioxide (SO_2) data were collected at the LaBarge study area in the 1980s. More recent sulfur dioxide (SO_2) data were collected by CASTNet in Pinedale and YNP, and by WARMS in Pinedale. Concentrations of sulfate (SO_4) from CASTNet and WARMS are also available. These concentrations are low and not increasing over time. Concentration of sulfur dioxide (SO_2) is about 1 ppb in YNP. Mean annual sulfur dioxide (SO_2) concentrations typically range from 1 to

10 ppb in remote areas, and from 20 to 200 ppb in polluted urban areas (Seinfeld 1986). Mean annual concentrations of sulfate (SO_4) are about 0.6 ppb in YNP. Sulfate concentrations in remote areas are typically about 0.6 ppb, and about 2.5 ppb in polluted urban areas (Stern 1973).

The weekly WARMS concentrations of sulfur dioxide (SO_2) from mid-1999 through 2001 were about 1.5 $\mu g/m^3$ or less. Mean annual concentrations of sulfur dioxide (SO_2) are typically less than 25 $\mu g/m^3$ in remote areas and range from 50 to 500 $\mu g/m^3$ in polluted urban areas (Seinfeld 1986).

Although it may not be appropriate to compare mean annual CASTNet sulfur dioxide (SO_2) concentrations with national or Wyoming standards, the CASTNet concentrations do suggest that sulfur dioxide (SO_2) concentrations are well below the NAAQS and WAAQS.

Ozone

Ozone (O_3) data were collected by the CASTNet station at Pinedale and YNP. Concentrations are relatively high (over 50% of the standards), but in compliance with the NAAQS and WAAQS. Mean annual ozone (O_3) concentrations in YNP have remained steady from 1989 through 1999.

Particulate Matter

Particulate matter (PM_{10}) data were collected at the Carbon County Underground Coal Gasification site in 1994 and 1995. Fine particulate matter ($PM_{2.5}$) data were estimated at one half PM_{10} concentrations as recommended by EPA. Mean annual PM_{10} concentrations were 24% of the NAAQS and WAAQS, and mean annual $PM_{2.5}$ were 40% of the NAAQS.

Visibility

The Inter-Agency Monitoring of Protected Visual Environments (IMPROVE) program has measured visibility in national parks and wilderness areas in the United States since the 1980s. There are four IMPROVE stations in Wyoming: Centennial, Pinedale, YNP, and North Absaroka. Visibility can be expressed in terms of deciviews (dV), a measure for describing perceived changes in visibility. One dV is defined as a change in visibility that is just perceptible to an average person.

Visibility data are calculated for each day, ranked from cleanest to haziest, and divided into three categories:

- 10% cleanest: 10th percentile - mean visibility for the 10% of days with the best visibility
- average: the 50th percentile - the annual median visibility
- 10% haziest: the 90th percentile - mean visibility for the 10% of days with the poorest visibility

In YNP, visual range on the 10% cleanest days varies from 110 to 160 miles, average visual ranges varies from 85 to 115 miles, and visual range for the 10% haziest days varies from 50 to 90 miles. Trend analysis shows that visibility in YNP has improved from 1988 to 1998.

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and is reported as the mass of material deposited on an area (kilogram per hectare). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation). Substances deposited include:

- acids: such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3); this acid deposition is sometimes referred to as acid rain
- air toxics: such as pesticides, herbicides and volatile organic compounds (VOC)
- nutrients: such as nitrate (NO_3) and ammonium (NH_4)

The estimation of atmospheric deposition is complicated by the contribution to deposition by several components: rain, snow, cloud water, particle settling, and gaseous pollutants. Deposition varies with precipitation, which, in turn, varies with elevation and time.

Wet Deposition

The National Atmospheric Deposition Program (NADP) assesses wet deposition by measuring the chemical composition of precipitation (rain and snow). There are 8 NADP stations in Wyoming. The natural pH of rainwater ranges from 5.0 to 5.6 (Seinfeld 1986). Mean annual pH at YNP has varied from about 5.1 to 5.7.

Mean annual wet deposition of ammonium (NH_4), nitrate (NO_3), and sulfate (SO_4) at YNP are low: about 0.5 kg/ha for ammonium (NH_4), less than 3 kg/ha for nitrate (NO_3), and less than 4 kg/ha for sulfate (SO_4). Mean annual deposition is typically less than 5 kilograms per hectare in remote areas. Wet deposition values from 1980 through 2000 are low and steady, indicating that deposition has not worsened during that time.

Dry Deposition

Dry deposition refers to the transfer of airborne gaseous and particulate material from the atmosphere to the Earth's surface. The Clean Air Status and Trends network (CASTNet) measures dry deposition of ozone (O_3), sulfur dioxide (SO_2), nitric acid (HNO_3), sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4). Mean annual dry deposition of sulfur- and nitrogen-containing compounds for YNP from 1990 through 1999 has been about 1 kilogram per hectare or less. Mean annual deposition is typically less than 5 kilograms per hectare in remote areas. Dry deposition values are low and steady, indicating that deposition has not worsened during that time.

Cultural and Natural History Resources

The planning area contains both prehistoric and historic cultural resources. It is not known if the planning area contains traditional cultural properties or sites considered sensitive to modern Native Americans. Less than 100 acres of formal class III inventory have been conducted on public lands and federal mineral estate in the planning area.

Prehistoric Resources

Prehistoric cultural resources are present in the planning area; however, formal inventory work conducted by the BLM is limited. Preserved sites are few in number on BLM-administered public lands because of the recent age of many of the Snake River floodplain sediments. However, two sites (48TE1195 and 48TE1443) occupy higher land and confirm prehistoric occupation in the planning area. These two known sites are not eligible for the National Register, and are in the "discharged use" category (see Glossary).

The earliest sites found in western Wyoming are Paleoindian localities. One Paleoindian locality of national significance is the Lawrence Site, found at the inlet to Jackson Lake, north of the planning area. Here, artifacts 10,000 to 11,000 years old have been located. More recent Archaic Period sites (9,000 years to 2,000 years old) containing dart points and Late Prehistoric Period sites (2,000 years old to about AD 1800, coming after the introduction of the bow and arrow) also occur in the planning area.

Prehistoric campsites are preserved in alluvial soils on the higher terraces of the Snake River. Sites predicted in this geomorphic setting include lithic scatters (predominantly containing obsidian), campsites, special use or extraction sites, stone alignments, hunting and fishing sites, and especially lithic procurement locales. The bluffs, terraces, and benches overlooking the Snake River can contain Pleistocene-aged quartzite cobble deposits exhibiting evidence of lithic procurement. The Teton Pass area is a major source of obsidian found in southwestern Wyoming archaeological sites and Teton Pass Obsidian will likely be identified in prehistoric sites of the planning area.

The Snake River may be named for the Shoshone (Snake) Indians and was a travel route for this tribe and others, such as the Bannock and the Flathead. Protohistoric Indian use by Numic speakers is postulated by at least one researcher (Butler 1983), so the presence of historic-period Native American sites is possible.

The soils include alluvial loams and extensive river-deposited quartzite cobbles. When cobbles dominate the surface, the potential for finding buried sites is low. The National Park Service (1997, p 27) indicated that regular changes in the river channel would tend to destroy or displace prehistoric sites in the Snake River floodplain.

The few prehistoric sites like 48TE1195 or 48TE1443 discovered on public lands so far may not meet National Register criteria, but they can add to our knowledge of the overall prehistory of the area. The fact of their preservation along the Snake River is noteworthy, in view of the overbank flooding, river channel meandering, and massive events of erosion and deposition. Source analysis of the obsidian recovered from these sites can shed important light on prehistoric trade routes and exchange in the region. Certainly, much of the prehistory along the Snake has been

lost. Studies at Jackson Lake (Conner, et al. 1991) have documented that dam construction and wave action severely damaged the many sites along that water source. Smaller sites such as 48TE1443 shouldn't be overlooked for their potential to increase our knowledge of prehistoric settlement patterns.

There is a low probability of locating rock art on public lands along the Snake River, due to the lack of sandstone cliffs suitable for the inscription of petroglyphs.

Historic Resources

The potential for locating historic period Euroamerican sites in the planning area is good. The first non-Native American to visit the Snake River area was Robert Stuart, an Astorian fur trapper who passed through in 1812 (Rollins 1935). The Snake River valley was settled in the mid- to late-nineteenth century, so Euroamerican cultural resources might be encountered. Historic Period sites projected to be within the planning area include homestead remains, such as the John Dodge homestead (Wilson 1985, p. 314), located on the east side of the Snake River, at the base of Gros Ventre Butte. An examination of Government Land Office maps dating between 1890 and 1917 identified several cabins, homesteads (for example, Harmenson's House, George Bonnet's Cabin), roads, fences, and trails along the Snake River. One site, "Morse's House" near Taylor Creek, is plotted on 1902 maps as being very near public lands on the Snake River. During river reconnaissance in 2001, BLM located the remains of what appears to be the eastern approach of an early Snake River Bridge on Parcel 9. This historic period cultural resource is not recorded, nor is it evaluated for National Register eligibility. Other possible historic period sites include stock maintenance sites, placer mining sites, historic levee constructions, historic dam or bridge remains, ferries, historic trash scatters, and other cultural material remains over fifty years of age.

The Snake River is famous for periodic flooding and many dikes, levees, water diversions, bank stabilizations, and other flood control structures were constructed during the historic period. There is a high potential for some of these features to be found on BLM-administered lands.

Lands along the Snake River may qualify as a rural historic landscape. The Snake River valley retains a high degree of "integrity of setting," as natural topography is unspoiled and frequently breathtaking. It is unknown whether the landscape contains "character-defining features" that contribute to the historical significance of a rural historic landscape. Future inventory may include an assessment of the area's historic landscape potential.

In recent years, there has been an increased interest in the archaeology near Jackson, Wyoming. Spurred by a series of NPS, USFWS, and FS projects, there is an increased understanding of the prehistory of the area. Most of these projects have concentrated on large sites where mitigative excavations took place.

Residents of Jackson frequent the public lands along the Snake River to fish, enjoy the river, walk their dogs, jog, bicycle, and to observe floaters going by. This intense public use may account for the lack of prehistoric tools on recorded, preserved sites in the planning area. No proactive, site-specific cultural inventories have been done for the planning area.

Fire Management

Fire History

Fire frequency during recorded history has been low, due to the moist riparian environment which keeps lightning caused fires from spreading. During periods of extreme drought, it is likely that catastrophic fires may have resulted from heavy fuel loading that accumulated during long fire-free intervals. Wildland fire ignitions on the BLM-administered public lands parcels have been infrequent, and are generally suppressed at 0.1 acre or less. In the summer of 2001, the Green Knoll Fire burned over 2,000 acres, mostly on the Bridger-Teton National Forest, in an area south of Wilson, WY, and west of the Snake River. The fire exhibited some extreme fire behavior, and threatened many homes in the area.

Plant Responses To Fire

Fire can be an effective tool in the long-term maintenance of narrow-leaf cottonwood riparian complexes. Most of the plants associated with the narrow-leaf cottonwood riparian complex are fire tolerant and resprout following light to moderate fires.

Narrowleaf cottonwood (*Populus angustifolia*) resprouts from roots, healthy and fire damaged branches, and root crowns after fire. Post fire sprouting generally occurs after light- to moderate-severity fire in pole sized and recently mature stands. The ability to produce post fire sprouts is greatly affected by stand age and location of the water table. Sprouting potential decreases proportionally as mature trees age. High water tables aid in the sprouting ability and subsequent sprout survival. Water insulates the tree's roots and reduces possibility of the tree being killed by the heat. The ability to resprout from branch fragments may also aid in post fire establishment (USDA 2002).

Fire generally increases the sediment load in streams when the majority of bank stabilizing vegetation is consumed. Narrowleaf cottonwood branch fragments have the ability to trap sediment for localized deposition by impeding stream flow. Fresh, moist, barren alluvium in full sun is very important in the regeneration of narrowleaf cottonwood. Regeneration through seeding is favored by fires that thin the overstory, allow more light penetration, and expose the mineral soil.

Due to the decreased probability of post fire sprouting by older mature trees, prescribed fires in narrowleaf cottonwood stands are not recommended past the pole and early maturation stages of development. Livestock grazing should be excluded for at least five years after fire, with wildlife browsing monitored.

Fire kills the aboveground portion of Canada thistle (*Cirsium arvense*) plants. The roots can survive severe fires. Overall, fire can slightly damage, or can enhance, Canada thistle. The plants can survive fire and sprout vegetatively from extensive perennial root systems, or colonize bare ground via seedling establishment after fire. When sites supporting Canada thistle are burned, its response is variable, and may be affected by season of burn, burn severity, site conditions, and plant community composition and phenology before and after the fire. Existing research provides no clear correlations with these variables (USDA 2002).

Spotted knapweed (*Centaurea maculosa*), a noxious species, will increase following fire (USDA 2002).

Fire Management – Appropriate Management Response Category

In accordance with the 2001 Federal Wildland Fire Management Policy, firefighter and public safety are the first priority in fire management. All parcels fall into Category A – Areas where wildfire is not desired at all. Suppression is required to prevent direct threats to life or property. The USDA Forest Service has fire protection responsibility for the BLM-administered lands in Teton County. Under a mutual aid and protection agreement, Teton County is a first responder to any wildland fire incident on BLM-administered public lands. Burned areas are evaluated to determine whether fire rehabilitation is needed.

Fuel Management

Several communities in the valley were identified as at high risk from wildfire in the August 17, 2001 Federal Register notice. Due to the riparian nature of the parcels and their proximity to private lands chemical treatments to reduce fuel loads are not appropriate. Mechanical or biological treatments could be used to reduce hazardous fuels in the urban interface. Projects will be analyzed on a case-by-case basis and the standard mitigtation guidelines will apply.

Desired Future Conditions

Maintain the existing mature cottonwood trees. See the Vegetation section for a description and Table 2-1, Vegetation Management section, for Objectives.

Emergency Stabilization and Rehabilitation (ESR)

Emergency stabilization and rehabilitation refers to activities that may be compeleted following a wildfire. Activities could include seeding with native or nonnative species, noxious weed control, erosion control, and repairing or building temporary fencing burned in the fire. If an evaluation indicates that any of these activites is needed, an ESR Plan will be prepared and implemented in accordance with the Department of the Interior Handbook and BLM ESR guidance.

Hazard Management and Resource Restoration

Public land administered by the BLM is used for a variety of permitted activities and also for illegal purposes, such as solid and hazardous waste dumping and illegal drug manufacturing. A few known dumpsites are located on the BLM Snake River parcels.

In addition to hazardous substance contamination, BLM lands are damaged by physical and environmental hazards. Natural hazards that can damage BLM lands and facilities include floods, snow loads, mudslides, and windstorms. Biological hazards are a new source of concern for the BLM, and include but are not limited to anthrax, bubonic plague, hantavirus, and foot and mouth disease. With the assortment of threats to human health and the environment, the major emphasis of the Hazard Management and Resource program is to manage hazards on public lands in order

to reduce risks to visitors and employees, restore contaminated lands, and to carry out emergency response activities.

Lands and Realty

Access

Access to the public land parcels is fair. While some parcels are easily accessed, others can be reached only from the river channel (see Appendix 4 and Maps 1 and 3-9). Parcels that have good access include some of the largest parcels and the most valuable for recreation, including parcels 9-10, 12-14, 17-19, and 26. Parcels 3 and 8 are accessible through GTNP, but only by hiking from public roads within the Park. Parcel 23 is accessible from the Fall Creek Road; however, it is difficult to determine where the parcel lies and the risk of trespassing on adjacent private lands is high. Parcel 27 can be accessed from US highway 189/191; however, it contains a trash transfer station and access is controlled by Teton County. Parcels 4-7, 11, 15-16, and 24 can only be accessed from the river, and it is extremely difficult to identify the parcels from the river channel.

Within the Snake River corridor, recreational access is available along levees maintained by the COE and Teton County, especially in the vicinity of Wyoming Highway 22 and Wilson Bridge. About 3 miles of levee on the west side of the river, leading south from Wilson Bridge, and 4 miles of levee east of the river and leading north from Wilson Bridge are accessible for hiking, horseback riding, skiing and other types of nonmotorized recreation. The access east of the river begins on public land near Emily Stevens Park, then crosses 11 acres of private land along an easement held by the Jackson Hole Land Trust, and continues on public land through the 320 acres of the Walton Greenway (Parcels 9-10, Map 5) .

A boat and river access site is located on the west side of the river immediately north of Wilson Bridge, on parcel 13 (Maps 1 and 5). Access to the Wilson boat ramp is currently private. There is no public easement to access the ramp. An easement could ensure continued public access to the Wilson boat ramp.

A second major area for boat and river access is near South Park Bridge, across the river from parcel 26 (Maps 1 and 9). The area is private land leased by the Wyoming Game and Fish Department (WGFD) and used as a take-out and put-in point by boaters floating from upstream or floating downstream. As described in an environmental assessment prepared by the Jackson Ranger District of the Bridger-Teton National Forest (February 7, 2000), the FS has proposed that the boat ramp be moved across the river to BLM-administered public land (parcel 26). The public land parcel is a better location for launching and landing boats during high water when the opposite bank is often flooded, and the public land parcel offers safer vehicle access from U.S. Highway 189/191. Teton County is proceeding, in cooperation with the BLM, to propose a boat ramp to be located on this parcel. A recreation project plan and environmental assessment (EA) for this project are being drafted by Teton County.

Restricted public use is allowed on most of the private lands in the Snake River channel through recreational easements. This access does not extend outside the river levees; in many cases it does not even include the levees themselves. The BLM was granted these easements and the

responsibility for their management as part of the judicial settlements determining the ownership of the Snake River omitted lands (see "Landownership"). These easements allow only very specific uses of the river on private lands, including floating, fishing, wading, hiking, and picnicking. Most notably, boats can be anchored for fishing in these areas. They do not allow individuals to cross upland private lands to reach the river. Other uses, including camping, building fires, and hunting, are prohibited on the easements. No maps of the recreation easements are currently available. However, metes and bounds descriptions of the easement boundaries are available in the Pinedale Field Office. The Pinedale Field Office, together with the BLM Wyoming State Office, is pursuing mapping the recreation easements.

Maintaining "open public access to...natural resource areas," including the Snake River, for vehicle use, biking, hiking, horseback riding, and skiing is a community goal described in the Jackson/Teton County Comprehensive Plan (1994).

Landownership

Map 1 depicts landownership patterns in the planning area. See Appendix 4 and Maps 3-9 for descriptions of individual parcels of public land administered by the BLM along the Snake River.

The pattern of private, state, and public landownership along the Snake River, and BLM's administration of recreational easements in that area, has an interesting legal history. Original surveys conducted in the late 1800s ended at "meander lines" established near the then-banks of the very wide, braided channel of the Snake River. At some points, this channel was a mile or more wide. These "omitted lands" (omitted from the official U.S. survey) remained in public ownership as the Jackson Hole valley was settled. As levee construction proceeded in the 1950s, the lands began to be separated from the active channel of the Snake River. In the 1970s and 1980s, after long litigation, many of the "omitted" parcels were awarded to the adjacent private landowners, resulting in the scattered nature of the parcels that remain in public ownership today. For most of the parcels that did go into private ownership, recreation easements to the river channel were granted to the United States (Map 1). Some of these easements include access to the riverbank levees. For the most part the public cannot use the uplands on private lands encumbered by the recreational easements; the easements generally only apply to lands in the Snake River channel that lie between the levees. The broader easements allow the public access to the levees, but never to lands upland of the levees. The later more restrictive easements preclude public access to the levees. These easements do not actually enhance access to the river, but allow activities on the river that are generally not allowed on navigable waters crossing private lands in Wyoming. For instance, on the Snake River through the planning area, recreationists can anchor boats, wade, hike, picnic, and fish on the river as it crosses private lands.

The BLM is also responsible for administering mineral exploration and development on approximately 15,123 acres of federal mineral estate (Map 2). The majority of this mineral estate lies outside the river corridor and underlies privately owned lands.

According to the Jackson Hole Land Trust website, roughly 9,000 acres of conservation easements, along with some private lands, have been purchased in and around Jackson Hole for the preservation of critical wildlife habitat, open space and scenic vistas, and historic ranching heritage.

The Jackson/Teton County Comprehensive Plan (1994) describes the acquisition of conservation easements as "an effective programmatic strategy for accomplishing natural resource protection and preservation of community character."

There is currently one Recreation and Public Purposes (R&PP) lease on BLM-administered lands. Parcel 27 is leased to Teton County for the Teton County Transfer Site (WYW-82509). Due to current regulations regarding hazardous materials, and Teton County's interest in this 40-acre site, this parcel should be sold to Teton County before the current lease expires (3/2/2015).

Rights of Way

There are no utility corridors designated on the BLM-administered lands. No interest has been expressed in developing utility corridors on the public land parcels; the parcels are disconnected, interspersed with private lands, and mostly located in riparian habitat on the river. Utility corridors would be more appropriately located in more accessible areas. BLM-administered lands do not contain suitable lands for communication sites. The BLM has granted several rights-of-way in the past for utilities and access roads. It is anticipated that sand and gravel development activity and the population growth in the area will continue to create a demand for rights-of-way.

Withdrawals

Withdrawals are used to preserve sensitive environmental values, protect major federal investments in facilities, support national security, and provide for public health and safety. They segregate a portion of public lands and suspend certain operations of the public land laws, such as desert land entries or mining claims. Land withdrawals can also be used to transfer jurisdiction to other Federal land-managing agencies. It is federal policy to restrict all withdrawals to the minimum time required to serve the public interest, maximize the use of withdrawal lands consistent with their primary purpose and eliminate all withdrawals that are no longer needed.

Approximately 2,890 acres of public lands and mineral estate described in public land order (PLO) 7143 (published on June 1, 1995 in the Federal Register, see Appendix 7) are closed to mineral or surface entry until June 1, 2005 (Map 12). As explained in the PLO, "mineral or surface entry" pertains to activities such as the staking and development of mining claims for locatable minerals and desert land entry, but does not apply to the sale, exchange, or transfer of public lands, or mineral leasing, or the extraction of sand and gravel through sales and permits.

Livestock Grazing

Livestock grazing is authorized in four grazing allotments totaling about 544 acres in the planning area (Map 14). The level of authorized use is 300 animal unit months (AUMs). Sixty-two AUMs are authorized for spring grazing subject to an annual authorization. The remaining use takes place primarily during the summer on 10-year grazing leases issued under section 15 of the Taylor Grazing Act. Only a few range projects have been constructed in these allotments. There are also about 437 acres of unallotted public lands.

No grazing allotment management plans or grazing systems have been implemented in the planning area, but some rangeland monitoring information, including actual use records, utilization studies, and field observations, has been collected. The condition of riparian areas has also been assessed.

The allotment categorization process (see Glossary) helps managers identify the intensity of management activity needed for each allotment. The Walton allotment (Parcels 9-10) was placed in the I (improve) category in 1999. Supporting documentation is available in the Pinedale Field Office.

All of the allotments have been assessed for conformance with the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management (Appendix 1). The Walton allotment (parcels 9-10) failed to meet standard #4 because of past heavy grazing use on a portion of the allotment, which has reduced the health of the native shrub community. Management changes intended to bring the allotment into compliance with the standard have been agreed to. There has been some difficulty in consistently applying these management changes. The Porter Estate allotment (parcel 21) also failed standard #4, although a cause could not be determined at the time the assessment was made. Monitoring is ongoing to determine a course of action that will address the condition of parcel 21. The Snake River Ranch allotment (parcels 23 and 24) met all the Standards (except Standard #2; see discussion in Watershed section of this chapter). Documentation of Standards assessments and subsequent management of all the allotments is available in the Pinedale Field Office. While parcels 15-16 are also under grazing lease to the Porter Estate, they have not been grazed by livestock in recent years and were not assessed for conformance with the Standards.

Livestock grazing is specifically mentioned in the settlement judgment for parcel 9, the Walton allotment. The Stipulation for Entry of Judgment was filed September 21, 1982, in the case between the United States and the Walton Ranch Company (United States of America v. Donald H. Albrecht, et al., U.S. District Court for the District of Wyoming, September 22, 1982). Item 5 of the Stipulation states:

> The United States agrees as part of the settlement entered into by the parties herein, that the Walton Ranch Company, or its successor in interest in ownership … shall have the right, as long as it or they are eligible under the laws and rules of the United States, to lease from the United States for grazing, agricultural or other authorized uses consistent with the maintenance of such property in its existing condition on the date hereof those parcels identified as 40, 41, 42, 43 and that portion of parcel 44 located north of the right of way line of Wyoming Highway 22, as long as the adjacent property of the Walton Ranch Company … is utilized for agricultural purposes. The right of the Walton Ranch Company to lease said parcels shall be subject to a determination by the United States in any legally mandated planning procedure that said parcels should be maintained in their existing condition and/or utilized for agricultural purposes. In the event that it is determined by the United States in a legally mandated planning procedure that any part of said parcels should not be maintained in its existing condition and/or utilized for agricultural purposes, the Walton Ranch Company shall have the right to lease the remaining portion of the tracts in accordance with the provisions of this stipulation. The United States agrees that it will, to the greatest

extent possible and permitted by law, insure that any use and/or development of any portion of the above described parcels will be consistent with the maintenance of such parcels in an optimum condition for the protection and preservation of aquatic and wildlife habitat.

Minerals and Geology

The planning area lies at the south end of the Jackson Hole basin (see Map 2). The landscape consists predominately of a floodplain composed of glacial outwash, with the glacial-shaped West Gros Ventre and East Gros Ventre buttes rising out of this plain. Volcanic activity, glaciers, running water, and movement along faults have shaped the present landscape over the last few million years. Glaciers have had the biggest role in current landform design. The Snake River has also had a significant contribution to the present day geomorphology. During the maximum glacial advance about 125,000 years ago (the Bull Lake Stage), ice covered the entire planning area. The ice sheet advanced south to the area of Munger Mountain. It once covered the tops of the Gros Ventre Buttes and was almost 2,000 feet thick in the vicinity of the town of Jackson (Good 1996).

Volcanic activity within the area is represented by basalt and andesite flows deposited on top of the Gros Ventre Buttes. Numerous hot and warm springs in and around the planning area provide evidence of hot magma at depth. Boyles Hill and Abercrombie Warm Springs occur within the planning area but are not located on BLM-managed public lands.

Tectonically, the area is one of the most active and structurally complex regions in the United States. Movement along the Teton and Hoback fault zones continues today, with earthquakes with magnitudes ranging from 1 to 6 occurring every few years. A magnitude 4 earthquake occurred along the Hoback Fault near Camp Davis in the spring of 1998. Higher magnitude earthquakes (greater than 7) occur every few thousand years. It is these more intense earthquakes that can modify landscapes and further displace fault scarps in moraine deposits along the east flank of the Teton Range. Two large Holocene earthquakes that created vertical displacement of 4.1 meters (13 feet) in surface alluvium and glacial deposits along the Teton Fault occurred about 7,175 years ago (Smith 1993). The Teton Range is one of the youngest mountain ranges in North America, with formation beginning about 13 million years ago. Today, the Tetons are still rising, and the Jackson Hole basin is still subsiding and receiving basin fill sediments.

Much of the tectonic activity of Jackson Hole is directly related to geologic events that have occurred in present-day Yellowstone and eastern Idaho over the last several million years. A series of deep magma plumes have risen from the earth's core to the surface over the last 15 million years to create explosive volcanic calderas. These eruptions have migrated northeast across southern Idaho where the most recent volcanic eruption created the Lava Creek Caldera in Yellowstone 600,000 years ago.

Mineral Resources

Leasable Minerals

Oil and Gas

There have been no oil and gas wells drilled within the planning area. The nearest wells to the planning area (all dry holes) were drilled along the Darby Thrust Fault in and around Hoback Junction, about 14 miles south of Jackson. All these wells were drilled in the late 1970s or early 1980s when petroleum prices were at their peak and justified the high risk of exploring a frontier area. The deepest well was drilled in 1981-82 to a depth of 16,350 feet in the Astoria Unit near Hoback Junction. There have been no oil and gas discoveries near the planning area. The nearest show was a noncommercial gas discovery from the Frontier Formation at Game Hill about 12 miles to the southeast.

The petroleum potential within the planning area north of the Cache Creek Thrust Fault is unknown. No deep drilling has taken place to evaluate the potential of the deep post Precambrian section underlying Jackson Hole. South of the Cache Creek Thrust Fault, the planning area is within the overthrust belt with a post-Precambrian rock section up to 20,000 feet thick. Potential for occurrence of hydrocarbons in the southern portion of the planning area is moderate.

In 1995, the US Geological Survey (USGS) conducted an assessment of the oil and gas resources of the United States. The assessment presents information about the undiscovered accumulations of oil and gas in various geologic or structural provinces from which hydrocarbons have been or may be produced. Information from that assessment concerning the Jackson Hole area is presented in Table 3-2.

TABLE 3-2
USGS CONVENTIONAL PLAY DATA FOR THE SOUTHWESTERN WYOMING PROVINCE

Play Name	Exploration Status	Producing	Oil Fields (>1 MMBO)		Gas Fields (>6 BCFG)	
			Size Range	Number Range	Size Range	Number Range
Moxa Arch LaBarge	Mature	Yes	5-20 MMBO	1-4	50-250 BCFG	2-7
Basin Margin Anticline	Immature-Moderately Mature	Yes	5-30 MMBO	1-3	12-100 BCFG	1-10
Subthrust	Immature-Moderately Mature	Yes	5-50 MMBO	1-5	20-150 BCFG	1-5
Jackson Hole	Immature	No	2-10 MMBO	1-3	9-40 BCFG	1-3

For this assessment, undiscovered, technically recoverable resources were defined as estimated quantities of resources hypothesized to exist on the basis of geologic knowledge, data from past discoveries, and resources that may be contained in undiscovered accumulations outside of

known fields. Estimates of resource quantities were determined to be producible using current recovery technology, but without considering economic viability.

As can be seen from the table, the possibility for several oil and gas fields exists in the Jackson Hole area. Potential production of oil and gas would be substantially lower than for other areas in southwest Wyoming. The exploration status of the Jackson Hole area can be described as immature, since little or no drilling has taken place in the area.

Geothermal

The geothermal potential within the study area is moderate to good. However, the potential for commercial development of the resource is low. Legislation has been introduced at the state and federal level on several occasions to protect geothermal resources within the greater Yellowstone ecosystem from drilling and development.

Abercrombie Warm Springs occurs at the north end of East Gros Ventre Butte along the Warm Springs Fault. Boyles Hill Warm Springs occurs along the Jackson Thrust Fault. Kelly and Teton Valley Warm Springs are found just northeast of the planning area while Astoria Warm Springs is located along the Snake River south of the planning area. The water temperature of these warm springs ranges between 80 and 100 degrees Fahrenheit. All the above springs occur on private and state lands.

Coal

No economic coal deposits exist within the planning area. The only coalmine known to exist within the area was on the northwest side of Boyles Hill. The long-abandoned mine went into the hillside at least 30 feet and the zone mined was in the steeply dipping Cretaceous-age Bacon Ridge Sandstone located near the Jackson Thrust Fault (Love 1972). The adit was originally timbered but is now caved in. No coal thickness was determined due to the lack of outcrops. The areal extent of this coal deposit is very limited, probably less than five acres. The coal was probably mined in the early part of the century and used locally to supply the heating needs of the Jackson area. Outcrops of the Aspen Shale in the southern portion of the area may contain low-grade, thinly bedded coal, but are not of economic significance. No other coal deposits are known to exist in the planning area.

Sodium, Potassium, and Oil Shale

The potential for the occurrence of these leasable minerals is low. No deposits are known to exist within the planning area.

Phosphate

The south half of the planning area (the Jackson quadrangle) was mapped in the late 1960s and early 1970s by the USGS in order to classify public lands, to investigate potential mineral resources, and to provide a basis for environmental planning (Love 1972). Actual and potential

resources identified include phosphate, coal, sand and gravel, limestone, and riprap. There are some public lands inside the planning area that have been classified for phosphate.

Nearly all phosphate is contained in the Meade Peak Member of the Phosphoria Formation. Outcrops of the Phosphoria Formation with phosphate-bearing beds occur on both East and West Gros Ventre Buttes. Exposures of the Phosphoria Formation also occur south of Snow King Mountain east of the Hoback Fault and U.S. Highway 189. Gere and others in 1966 exposed phosphate beds in a trench dug on the south side of Snow King Mountain in the northeast corner of sec. 9, T. 40 N., R. 116 W. Two phosphate beds were exposed in the Meade Peak Member. One bed was 4.4 feet thick (containing 23 percent phosphate) and another bed was 12 feet thick (assayed at 15 percent phosphate). Additional lands classified as potentially valuable for phosphate lie west of the planning area and south of Teton Pass.

Outcrops of the Phosphoria Formation in the areas described have very limited extent due to steep bedrock dips of 15 to 60 degrees. Because of these limited exposures and steep dips in mountainous terrain, it is unlikely that any phosphate would be developed.

Salable Mineral Deposits

The most important mineral material occurring within the planning area is gravel. Extensive deposits occur in terraces and along the floodplain of the Snake and Gros Ventre Rivers. The glacial deposits of gravel are generally 50 to 100 feet thick along the Snake River but in some areas, as under the town of Jackson, the gravel thickness may reach 300 feet. The planning area in the past contained many gravel pits and quarries to meet the needs of highway, county, and private road construction. Today, the planning area contains only three gravel operations. Two are companies operating on private lands along the Snake River. The third operation was located north of the South Park highway bridge to supply gravel for widening U.S. Highway 189 south of Jackson. No sand or gravel is currently being commercially produced from federal lands or mineral estate in the planning area.

Demand for sand and gravel in Jackson Hole is increasing as the number of homes, businesses, and roads in the area continues to grow. The private gravel operations have limited resources.

In portions of the river where gravel is currently being extracted from private lands, high river flows in the spring have been replacing the gravels extracted in the previous year. This creates a unique situation where a supply of gravel is available annually, without the creation of an ever-enlarging gravel pit. In some portions of the river, particularly upstream of highway bridges, streambed gravels are building up and have caused channel aggradation of up to nine feet above the 1954 channel level.

Another mineral material of somewhat less importance is riprap. Demand for riprap is great along the Snake River to build and maintain the river levees. Maintaining these levees is important to prevent flooding and thereby protect surrounding real estate. Riprap can be obtained from existing quarries in volcanic rocks located upon East and West Gros Ventre Buttes. Talus debris at the bottom of the buttes may also supply some riprap demands.

Locatable Minerals and Mining Claims

There are no active mining claims within the planning area; however, claims have been located in the past. The most recent claims were located in the late 1960's, with the latest activity in 1982. For the most part, these were placer claims located along the Snake River for gold. All claims in the planning area have been abandoned.

Gold is the primary locatable mineral deposit within the planning area. The potential for the occurrence of gold within the river gravels is low. Placer gold was first discovered in the Snake and Gros Ventre River gravels in the 1860's. The gold occurs as minute flakes and flour within large volumes of sand and gravel. The source area for the gold is unknown.

The potential for placer gold development is low within the study area, since it is unlikely that sufficient amounts of gravel could be mined to make an operation profitable. No past placer operations in Jackson Hole Valley are known to have yielded economically profitable amounts of gold (Love 1972).

Mineral Withdrawal

Approximately 5,937 acres of public lands and mineral estate described in public land order (PLO) 7143 (published on June 1, 1995 in the *Federal Register*, see Appendix 7) are closed to mineral or surface entry until June 1, 2005 (Map 10). As explained in the PLO, "mineral or surface entry" pertains to activities such as the staking and development of mining claims for locatable minerals and desert land entry, but does not apply to the sale, exchange, or transfer of public lands; mineral leasing; or the extraction of sand and gravel through sales and permits. Public land and mineral estate not included in the area described in PLO 7143 are currently open to locatable mineral or surface entry.

Geologic Hazards

Potential geologic hazards in the planning area include river flooding, earthquakes, and landslides. In general, the risk of property damage (and possible human injury) caused by geologic hazards is increased as development of the Jackson Hole area increases.

Flooding

The greatest near-term hazard is from river levee failure during extreme high water in the Snake and Gros Ventre rivers. Flows usually peak from mid-May to early July each year. Rapid erosion and possible flooding may occur with flow rates exceeding 20,000 cubic feet per second. The COE is the primary agency responsible for building and maintaining the Snake River levee system and protecting the surrounding lands from flooding.

Construction of the levee system for flood control was begun in the 1950s. The levees have been expanded over the years as needed to improve flood control. Unfortunately, the levees have restricted the river's flow and changed the dynamics of the system, primarily by increasing the

erosive force of the water. Because many homes have been built in the floodplain, an increasing number of private levees are being constructed to protect the real estate.

When flooding along the Snake River does occur, as in the spring of 1986, levees can fail and land with riverbank trees can be swept into the river. Later these trees and other woody debris catch in the river channel and create new "snags." The snags then collect silt and gravel and change the hydrodynamics of the river system. If the snags are left in the river, future erosion of the levees with potential flooding is more likely. The COE estimated in 1988 that the Snake River had about 10,000 snags from the south boundary of GTNP to the South Park Bridge. The COE completed an environmental study in 1989 and 1990, which addressed removing some of these snags to restore some of the main river channel.

Higher than normal snow melt occurred in the spring of 1997 and high water flows destroyed a levee on public land where Butler Creek enters the river. With the levee gone, valuable ranch land was swept into the river.

Earthquakes

Within the planning area are portions of the active Teton and Hoback normal faults. For the most part, earthquakes have been frequent (every year or so) and have been low in intensity. Little property damage due to earthquakes has occurred in the past hundred years. A magnitude 6 earthquake occurred in 1932 near the town of Jackson. A magnitude 6 earthquake also occurred at Teton Pass in 1948 where the Cache Creek and Jackson thrust faults intersect. There have been at least five other earthquakes in the planning area vicinity with magnitudes of 4 or 5 over the past 70 years.

The potential for property damage has increased, especially in the northwestern portion of the planning area. Today, more and more homes are built away from the valley floor upon slopes and loosely consolidated alluvial fan deposits. As a consequence, even small intensity quakes may activate landslides and dislodge boulders, resulting in property damage.

Landslides

Landslides and mudslides are another geologic hazard within the planning area. Landslides caused U.S. Highway 189 to be rerouted from the east bank of the Snake River to the west bank, and the South Park bridge to be built. Here soft Tertiary shale and sandstone rock has slid toward the riverbank as the Snake River exits the Jackson Hole valley and enters the upper Snake River Canyon. The fast moving water has cut into this steep bank as the Snake River makes a sharp bend southeast of the South Park highway bridge.

The most famous recent landslide of the region is the Lower Gros Ventre Slide. This slab-type slide occurred in 1925 when Pennsylvanian-aged rocks on the north slopes of Sheep Mountain slid north, blocking the Gros Ventre River. A natural dam 225 feet high was created. Water backed up behind the debris dam and created Lower Slide Lake, which is two miles long. Two years later in the spring of 1927, the top 50 feet of this natural dam broke and flooded the Gros Ventre valley. This sudden wall of water destroyed the village of Kelly, with a loss of six lives (Love 1997). Other more ancient landslides exist further up the Gros Ventre River drainage

system. The Lower Gros Ventre Slide is located about 12 air miles northeast of the planning area (for the geology of the slide area, see Love 1992).

Further to the south in the spring of 1997, a mudslide blocked U.S. Highway 89 just south of Hoback Junction. Landslides are most prone to happen in the spring when the ground is saturated with snowmelt and glide planes are well lubricated.

Off-Highway Vehicles

Most of the existing roads on the public land parcels are part of the US and/or Teton County transportation system. Off-highway vehicles (OHVs) that are used in the planning area include snowmobiles, motorcycles, all-terrain vehicles, and mountain bikes. OHV use on BLM parcels in the planning area is minimal, due to limited public road access. However, some unauthorized trails are becoming established. Motorized boating occurs but is not currently a popular activity. Mountain biking on the levees is a common recreation activity. Some mountain bike use is also occurring off road and contributes to the maintenance of unauthorized trails.

The BLM recognizes the use of bicycles and other human-powered, mechanized conveyances as appropriate recreational activities. While Federal regulations do not specifically address management of non-motorized vehicle use, a National Mountain Biking Strategic Action Plan was finalized in November 2002. When BLM produces program guidance for managing mountain biking use, this plan will comply with that guidance. There are substantial differences in the types of use, associated impacts, and management approaches between non-motorized and motorized vehicle activities. Until rules for non-motorized vehicle use on public lands are established, the BLM will continue to include non-motorized use within the context of OHV designations.

Paleontological Resources

Pleistocene-age river terrace deposits along the Snake River have a very slight potential to contain vertebrate fossils. The occurrence of fossils in the river gravels and riparian areas is very remote. There is a slightly higher potential for fossil occurrence on parcels that include lands above the river terraces.

Recreation

The types of recreation activities available on BLM-administered lands in the planning area or as a result of public access include: float fishing and scenic floating, both private and guided; waterfowl hunting; mountain biking; hiking, dog walking, wildlife viewing, cross-country skiing and OHV activities. The season of use for the planning area is year long; there are recreation activities for any season of the year. Visitor use is highest during the summer months. In addition to public lands in the planning area, recreation easements on private lands within the river levees provide for recreation access for the purposes of boating, rafting, fishing, hiking, and picnicking. Some of these easements include access to the riverbank levees. For the most part the public cannot use the uplands on private lands encumbered by the recreational easements; the easements generally only apply to lands in the Snake River channel that lie between the levees.

The broader easements allow the public access to the levees, but never to lands upland of the levees. The later more restrictive easements preclude public access to the levees. These easements do not actually enhance access to the river, but allow activities on the river that are generally not allowed on navigable waters crossing private lands in Wyoming. For instance, on the Snake River through the planning area, recreationists can anchor boats, wade, hike, picnic, and fish on the river as it crosses private lands. Unlike most areas in Wyoming, recreationists may anchor boats, wade, swim, and hike in the river channel where the underlying surface is private land. Hunting, open fires, and overnight camping are prohibited on all recreation easements on private lands. Public lands in the planning area are closed to overnight camping.

The majority of river floating activity occurs during the warmest months following the high flows of early summer snow melt. Float fishing use begins in April with the opening of trout fishing season and peaks as fishing conditions improve during late summer and fall. Walking, biking, and horseback riding are the most common upland activities. Swimming and wade fishing are also popular activities and most commonly occur near the public access locations provided at the Wilson Bridge and near Emily Stevens County Park. A few lesser-known road-accessed river locations provide additional river corridor access.

The only developed boating access on public lands is the Wilson Bridge boat ramp (parcel 13, Map 5). The Wilson Bridge boat ramp is a boating take-out and put-in for approximately 23 miles of the Snake River. This access, developed in cooperation with Teton County, consists of a gravel ramp for launching and landing boats, a parking area, restrooms, and information kiosk. The NPS provides boating access at Moose, Wyoming, for floating downstream to the Wilson Bridge access. Private landowners provide some limited floating access.

The WGFD provides other public boating access through an access agreement on private lands located at the north end of the South Park Bridge. An area on public lands on the south side of the South Park bridge (parcel 26, Map 9) has occasionally been used for landing and launching boats, but has not been developed for this purpose. There is currently a proposal to develop a boat launch area on public lands near the South Park bridge.

Commercially guided scenic float and fishing trips are popular in the planning area as part of the tourism-based economy of the town of Jackson. Commercial, competitive, and large group floating activities are currently unregulated within the planning area, except where floating access is provided by the NPS in Moose, Wyoming. The FS regulates commercial, competitive, and group use in river segments below the South Park bridge. Commercial and private floating use fluctuates yearly, but water-based recreation activity and demand throughout the region has increased dramatically over the past 20 years. The demand for these services and activities will likely continue to grow. River use allocation measures have been implemented by other land management agencies to protect wildlife habitat, provide for human health and safety, and maintain a quality recreation experience. The commercial floating and large group floating use is at times at or near maximum use levels. The river segments within the planning unit provide for substantial commercial and private floating use. Rough estimates of floating use in the Wilson to South Park floating segment exceed 25,000 people per floating season. Up to 60 boats per day may launch from the Wilson Bridge boat ramp. Upland use by the public for recreation activities on public lands and easements within the river corridor likely exceeds 25,000 visits per year. The demand for recreation facilities and recreation activities currently exceeds the supply of services and opportunities. This imbalance is expected to continue regardless of applied existing or future

management scenarios. A trend of increasing recreation visitation is also expected to continue, further widening the gap between supply and demand.

Recreation Opportunity Spectrum

Public lands are managed to provide a broad spectrum of recreational opportunities. The recreation opportunity spectrum (ROS) provides the BLM with a framework for determining existing outdoor recreation opportunities and management potential based upon a combination of activity, setting, and experience.

Use of the ROS provides for establishment of outdoor recreation management goals and objectives for specific areas, provides for analysis of the impact of proposed resource management actions on available recreation opportunities, provides for monitoring in terms of established standards for recreation experience and opportunities settings, and provides for specific management objectives and standards for project plans.

The ROS system divides the continuum into six management classes, with "primitive" providing the most isolated, natural, and challenging setting and "urban" providing the most user intensive, developed, and modified setting. The ROS classifications for this planning process were described based upon what the recreationist may see, hear, and experience from the river corridor where public lands and recreation easements allow for public use management. The six classes are: primitive, semi-primitive nonmotorized, semi-primitive motorized, roaded natural, rural, and modern urban. The ROS classifications for the Snake River corridor are depicted on Map 16.

The recreation opportunity spectrum system describes probable physical settings, experiences, and activities for each class and identifies where these combinations occur within the planning area. Area classification allows for flexibility where the overlapping of class characteristics commonly occurs. The use of this system on public lands will help better recognize and meet the public's growing demand for a wide variety of recreation activities and settings within the planning area.

Socioeconomics

Overview

Jackson is located in northwest Wyoming and serves as a gateway to Grand Teton and Yellowstone National Parks. It is located in a scenic valley known for the surrounding majestic mountains and beautiful vistas. As a result of the beauty of the area, tourism is an important component of the local economy. In addition, given this backdrop, Jackson is a highly desirable place to live. This desirability can be contrasted against the high cost of living in the area.

Due to high housing costs, Teton County is the most expensive county in Wyoming in which to live (State of Wyoming 2001). The cost of living in Teton County is, on average, 41% higher than in all the other counties in Wyoming. This is a significant cost of living differential that sets Jackson apart from the rest of the state.

Population

The population growth rate from 1970 through 2000 for Jackson and Teton County has been substantially greater than the average for the state of Wyoming, as shown in Table 3-3. This high, sustained growth rate for the 30-year period beginning in 1970 illustrates the desirability of the Jackson area. In addition, it reveals the potential for an increase in demand for local access to public land along the Snake River.

The Wyoming Department of Administration and Information projected the populations of Jackson and Teton County would be 6,701 and 16,280, respectively, by 2008. However, Table 3-3, with information from the 2000 Census, indicates the forecast was underestimated. Both Jackson and Teton County had surpassed the population forecast for 2008 by the year 2000.

TABLE 3-3
POPULATION

Year	1970	1980	1990	2000
Jackson				
Population (number of persons)*	2,688	4,511	4,472	8,647
Compound Annual Growth Rate (10 year increments)		5.31%	-0.09%	6.82%
Compound Annual Growth Rate (1970 base year)				3.97%
Teton County				
Population (number of persons)*	4,823	9,355	11,172	18,251
Compound Annual Growth Rate (10 year increments)		6.85%	1.79%	5.03%
Compound Annual Growth Rate (1970 base year)				4.54%
Wyoming				
Population (number of persons)*	332,416	469,557	453,588	493,782
Compound Annual Growth Rate (10 year increments)		3.51%	-0.35%	0.85%
Compound Annual Growth Rate (1970 base year)				1.33%

*U.S Bureau of Census

Income

Tourism is an important component of the local economy in Jackson and Teton County. As illustrated in Table 3-4, the sectors entitled retail trade and services have been growing at an adjusted annual compound rate of 5.54% and 6.48%, respectively, from 1970 through 2000 (measured in 2000 dollars). Moreover, retail trade is growing at a rate that is 73% greater than the growth rate for retail trade for the state of Wyoming (Table 3-5).

It is also interesting to note that services accounted for nearly 25% of personal income in Teton County, compared to only about 13% of personal income in Wyoming, in 2000. Also, in 2000, retail trade constituted nearly 9.5% of personal income in Teton County, compared to only 6.2% of personal income for the state of Wyoming. As a percentage of personal income, the sectors making up the bulk of the tourism economic activity are much more important to the Teton County economy than to the Wyoming economy as a whole.

Teton County has been experiencing a substantial growth rate in population. This is reflected in four of the sectors: construction; retail trade; finance, insurance and real estate; and services. The annual adjusted growth rate difference from 1970 to 2000 in these four categories for Teton County compared to the state of Wyoming is, respectively, 73.26%, 72.99%, 60.45% and 41.35% higher.

TABLE 3-4
PERSONAL INCOME, TETON COUNTY

	1970	1980	1990	2000	Compound Annual Growth Rate
Personal income	134,933	294,069	510,621	933,387	6.66%
Nonfarm personal income	130,322	292,796	509,101	933,510	6.78%
Farm income[1]	4,611	1,273	1,520	-123	
Earnings by place of work	97,311	210,694	360,418	638,655	6.47%
less: Personal cont. for social insurance[2]	3,488	9,122	24,423	42,553	8.70%
plus: Adjustment for residence[3]	-555	-6,000	-40,875	-97,123	18.79%
equals: Net earngs by place of residence	93,268	195,572	295,121	498,979	5.75%
plus: Dividends, interest and rent[4]	36,672	85,661	193,683	399,688	8.29%
plus: Transfer payments	4,993	12,836	21,817	34,720	6.68%
Wage and salary disbursements	65,467	137,946	263,516	475,034	6.83%
Other labor income	2,734	13,621	27,435	41,494	9.49%
Proprietors' income[5]	29,110	59,127	69,449	122,127	4.90%
Farm proprietors' income	2,206	-698	542	-1,055	
Nonfarm proprietors' income	26,904	59,825	68,908	123,182	5.20%
Farm earnings	4,611	1,273	1,520	-123	
Nonfarm earnings	92,700	209,422	358,898	638,778	6.65%
Private earnings	75,537	176,001	312,756	561,772	6.92%
Ag. Services, forestry, fishing, & other[6]	746	788	1,760	7,967	8.22%
Mining	852	14,497	1,265	(D)	8.16%
Construction	9,218	34,699	54,898	117,143	8.84%
Manufacturing	3,484	6,382	7,822	15,083	5.01%
Transportation and public utilities	2,694	7,367	9,846	21,205	7.12%
Wholesale trade	1,172	4,353	5,341	(D)	
Retail trade	17,544	35,111	58,071	88,517	5.54%
Finance, insurance, and real estate	4,966	9,636	17,909	66,455	9.03%
Services	34,862	63,169	155,843	229,072	6.48%
Government and government enterprises	17,162	33,420	46,142	77,006	5.13%

TABLE 3-5
PERSONAL INCOME, WYOMING

	1970	1980	1990	2000	Compound Annual Growth Rate
Personal income	5,806,353	11,646,597	10,750,231	13,521,575	2.86%
Nonfarm personal income	5,435,440	11,466,606	10,559,189	13,412,188	3.06%
Farm income[1]	370,913	179,991	191,042	109,387	-3.99%
Earnings by place of work	4,579,659	9,481,940	7,530,552	8,940,138	2.25%
less: Personal cont. for social ins.[2]	161,615	434,627	443,716	546,999	4.15%
plus: Adjustment for residence[3]	586	-160,186	-15,830	-33,763	
equals: Net earngs by place of res.	4,418,630	8,887,127	7,071,006	8,359,376	2.15%
plus: Dividends, interest and rent[4]	933,448	1,941,106	2,512,872	3,561,517	4.56%
plus: Transfer payments	454,275	818,364	1,166,353	1,600,682	4.29%
Wage and salary disbursements	3,483,912	7,382,858	5,562,081	6,772,578	2.24%
Other labor income	211,952	864,057	793,082	803,106	4.54%
Proprietors' income[5]	883,794	1,235,025	1,175,390	1,364,454	1.46%
Farm proprietors' income	231,556	59,840	124,188	29,084	-6.68%
Nonfarm proprietors' income	652,239	1,175,186	1,051,201	1,335,370	2.42%
Farm earnings	370,913	179,991	191,042	109,387	-3.99%
Nonfarm earnings	4,208,746	9,301,949	7,339,511	8,830,751	2.50%
Private earnings	3,117,233	7,649,396	5,366,109	6,735,326	2.60%
Ag. Svcs, forestry, fishing, other[6]	27,215	30,425	50,777	73,498	3.37%
Mining	547,538	2,368,178	1,310,740	1,326,625	2.99%
Construction	377,198	1,131,352	498,755	760,400	2.36%
Manufacturing	274,686	433,727	365,436	471,765	1.82%
Transportation and public utilities	481,361	924,125	740,282	767,328	1.57%
Wholesale trade	144,195	414,417	250,765	298,233	2.45%
Retail trade	536,004	875,953	695,019	837,076	1.50%
Finance, insurance, & real estate	155,961	290,903	247,437	446,889	3.57%
Services	573,075	1,180,316	1,206,898	1,753,512	3.80%
Government and govt enterprises	1,091,513	1,652,554	1,973,401	2,095,425	2.20%

Footnotes for tables 3-4 and 3-5 (all figures are in 2000 dollars):

[1] Farm income consists of proprietors' income; the cash wages, pay-in-kind, and other labor income of hired farm workers; and the salaries of officers of corporate farms.
[2] Personal contributions for social insurance are included in earnings by type and industry but they are excluded from personal income.
[3] The adjustment for residence is the net inflow of the earnings of interarea commuters.
[4] Rental income of persons includes the capital consumption adjustment.
[5] Proprietors' income includes the inventory valuation adjustment and capital consumption adjustment.
[6] "Other" consists of wage and salary disbursements to U.S. residents employed by international organizations and foreign embassies and consulates in the United States.

(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

*REIS, Regional Economic Information System 1969-98, U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis

Per Capita Income

Per capita income provides a good indicator of the economic well being of an area. Teton County has, by a large margin, the highest per capita income in the state of Wyoming, with a 2000 per capita income of $50,913. Per capita income in Teton County is 86% higher than for the state of Wyoming for the year 2000 (Table 3-6).

TABLE 3-6
PER CAPITA INCOME, TETON COUNTY AND WYOMING

	2000
Wyoming	27,372
Albany	23,772
Big Horn	19,884
Campbell	27,601
Carbon	23,434
Converse	23,381
Crook	22,846
Fremont	22,267
Goshen	22,921
Hot Springs	23,393
Johnson	24,381
Laramie	28,035
Lincoln	20,980
Natrona	32,112
Niobrara	23,355
Park	26,686
Platte	23,984
Sheridan	28,221
Sublette	26,927
Sweetwater	29,125
Teton	50,913
Uinta	22,042
Washakie	25,428
Weston	26,280

Summary

The population growth in Teton County increases the demand for access to public land along the Snake River corridor. Additionally, the growth in tourism increases the demand for access to these same public lands. No other lands along the Snake River in Teton County provide the type of river access, close to town and residences, available on the public lands in the planning area.

The importance of tourism to the Teton County economy points out the consequence of recreational expenditures to the overall vitality of the county's economy. One way of examining these recreational expenditures is to identify the new money coming into the local economy as a result of tourism, and then use a regional model, such as an Input/Output model, to quantify the direct, indirect and induced impacts associated with a particular alternative. However, for this RMP EIS, the analysis will focus on the non market values of the public lands along the Snake River corridor as they relate to the different management alternatives being considered. The private real estate market influences the value of public lands in the Snake River planning area. However, in addition to the high land prices in Teton County, there are additional values attached to these public lands that are not measured in the private market. Non-market values of the BLM parcels were further studied in a Contingent Valuation Methodology study conducted in 2001 (see Appendix 6).

Soils

Soils found along the Snake River floodplain generally are dark, poorly drained, and have a fine sandy loam surface about 24 to 30 inches thick overlying extremely gravelly loamy sand to a depth of 60 inches or more. These soils are characterized by a fluctuating water table between 3 feet and the surface from May through July and are subject to flooding from May through June.

The plant community is dominated by species that tolerate a high water table. Cottonwood, willow, hawthorn, buffaloberry, silverberry, and currant are common woody species.

Flooding and high water tables put severe limitations on building site development, sanitary facilities, and permanent recreational facilities. Wildlife habitat potential is good and the potential as a gravel source is good. These soils are a poor source for topsoil and for material with which to construct dikes, embankments, or levees.

Upland areas, with slopes from 10 to 90%, are dominated by dark, well drained, silt loam or loam soils greater than 60 inches to bedrock. Some areas have rock fragments throughout the soil profile.

The plant community is characterized by sagebrush along with bitterbrush, serviceberry and snowberry, and grasses in the open areas, while lodgepole pine and Douglas fir are often found on forested hillsides.

Steep slopes are the main limitation to building site development, sanitation facilities, and permanent recreational facilities. Wildlife habitat potential is fair to good. These soils are a poor source for gravel or topsoil.

Detailed soils information for this area can be found in: Soil Survey of Teton County, Wyoming, Grand Teton National Park Area, 1982, USDA-Natural Resource Conservation Service.

Special Status Plant Species

Complete floristic inventories have not been conducted on a large scale in the Bureau; information available on each species varies, as do potential threats and opportunities for management and protection. Site specific and general inventories have been conducted for some species; however, areas inventoried but having no candidate plants frequently were not mapped and/or the information was never placed in reports that could be referenced. Permanent transects have been established and baseline information gathered for other species. Complete information is lacking for many of the species.

The BLM is required by law to protect and manage for threatened, endangered, proposed, and candidate species identified by the USFWS. Four plants known to occur in Wyoming have been listed as threatened or endangered under the Endangered Species Act (ESA). BLM is also required to protect and manage for state listed species. The State of Wyoming does not have an official list of rare, threatened, or endangered plant species. Wyoming BLM has established a list of BLM state sensitive species. BLM is required to protect these plants at the minimum level of

protection as a federal candidate species. State and federal agencies have historically given these species special consideration until their status is accurately assessed.

Federally Listed Species

The planning area has one known federally listed plant species near its boundaries. The other listed or proposed species are located in the central and eastern portions of Wyoming.

Ute Ladies'-tresses (*Spiranthes diluvialis*), an orchid listed as threatened, has been located along the South Fork of the Snake River in Idaho, and similar habitat occurs along the Snake River corridor in Wyoming. Several searches have found suitable habitat but no individuals within the planning area. A survey conducted for the Fall Creek Road improvement project also found no individuals of this species. This species does not produce growth every year, so it is possible that the species does occur and has not been found yet; however, the elevation of Jackson Hole is thought to be too high for the species. The likelihood that the Ute ladies'-tresses occurs in the planning area is low.

BLM Sensitive Species

The Pinedale Field Office has six BLM sensitive species within its boundary. Their habitat is not found within the Snake River Corridor and the species are not likely to be found in the planning area. Table 3-7 lists the species and their associated habitats.

TABLE 3-7
SENSITIVE SPECIES

Common Name	Scientific Name	Habitat
meadow pussytoes	*Antennaria arcuata*	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands 4,950-7,900'
Trelease's milkvetch	*Astragalus racemosus var. treleasei*	Sparsely vegetated sagebrush communities on shale or limestone outcrops and barren clay slopes at 6,500-8,200'
Cedar Rim thistle	*Cirsium aridum*	Barren, chalky hills, gravelly slopes, and fine textured, sandy-shaley draws 6,700-7,200'
large-fruited bladderpod	*Lesquerella macrocarpa*	Gypsum-clay hills and benches, clay flats, and barren hills 7,200-7,700'
Beaver Rim phlox	*Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, or limestone substrates 6,000-7,400'
tufted twinpod	*Physaria condensata*	Sparsely vegetated shale slopes and ridges 6,500-7,000'

Vegetation

General Description

Most plants found on the Snake River floodplain are intricately related to sediment deposition and water discharge patterns over time. Sediment deposition provides the substrate (soil) for plants, while water levels relative to sediment surfaces provide water for growth of established plants and seed germination (Merigliano 1996).

The COE has developed generalized categories in which to group the vegetation cover types of the Snake River in Jackson Hole. These are: Riparian Forested, Riparian Shrubland, Riparian Grassland, Upland and Palustrine, and Riverine. While all of these types may occur to some degree along the river reaches under BLM's jurisdiction, the principal cover type is the Riparian Forested.

A narrow-leaf cottonwood riparian complex dominates the Riparian Forested cover type within the river corridor. Common riparian plants found along the Snake River include:

Canada goldenrod (*Solidago canadensis*)
Douglas fir (*Pseudotsuga menziesii*)
Engelmann spruce (*Picea engelmannii*)
goldenaster (*Heterotheca villosa*)
Kentucky bluegrass (*Poa pratensis*)
licorice root (*Glycorrhiza lepidota*)
lodgepole pine (*Pinus contorta*)
narrow-leaf cottonwood (*Populus angustifolia*)
quaking aspen (*Populus tremuloides*)
red-osier dogwood (*Cornus stolonifera*)
redtop (*Agrostis stolonifera*)
reed canarygrass (*Phalaris arundinacea*)
sandbar willow (*Salix exigua*)
silverberry (*Elaeagnus commutata*)
subalpine fir (*Abies lasiocarpa*)
water birch (*Betula occidentalis*)
western serviceberry *(Amelanchier alnifolia*)
western wheatgrass (*Elymus smithii*)
yellow willow (*Salix lutea*)

This vegetation screens much of the river corridor from human intrusions and alterations. However, land uses occurring along much of the river's edge are altering the natural vegetation.

Condition

In 1990, the USFWS predicted a declining trend for the cottonwood forests along the Snake River corridor due to a lack of overbank flooding necessary for new stand stimulation. Cover type mapping performed by the COE supports this hypothesis. Long-term replacement of these stands depends on periodic habitat conditions caused by flooding and floodplain scouring. The declining trend in vegetation condition is likely to continue with the operation and maintenance of the flood-control levees.

Disturbances, such as maintenance and construction of levees, open large areas for colonization by opportunistic species. The disturbance reduces or eliminates other plant species and allows for exploitation of the resources present. The levees, and activities associated with them, create a corridor of disturbance that initiates a shift in the herbaceous species composition from one dominated by natives to one dominated by exotic (and noxious) weeds.

Noxious weeds common to the Snake River corridor include: spotted knapweed (*Centaurea maculosa*), Dalmatian toadflax (*Linaria dalmatica*), houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), and musk thistle *(Carduus nutans*).

Present Use

The mature riparian forests are beneficial to many wildlife species. These stands provide hiding, nesting and thermal cover for a broad variety of birds and mammals. The vegetation communities provide forage for domestic livestock and for native wildlife. The cottonwood forests provide aesthetically pleasing stop-over areas for river floaters. Mushroom hunters search for morels under cottonwood stands during the spring and early summer.

Visual Resources

The Snake River and its cottonwood forest, backed by the Teton, Gros Ventre, and Snake River mountain vistas, provides some of the greatest scenic values in Wyoming. This scenery is also integral to the recreation and tourism-based economy of Jackson and Teton County. Several of the public land parcels provide views of the Grand Teton and other peaks in the Teton Range. The river and cottonwood forests provide scenic backdrop to many homes in the area.

A visual resource inventory and classification process was performed for the planning area as viewed from the riparian corridor of the Snake River, where most human activity on public lands occurs. A visual resource inventory provides 1) an inventory tool that portrays the relative visual quality of a landscape, and 2) a management tool that delineates visual protection standards by which surface disturbing activities may occur and establishes guidelines for the rehabilitation of existing projects, facilities and disturbances. The visual resource inventory and classification process is based upon a qualitative analysis of like scenery, as observed from appropriate distance zones and with consideration of the public's sensitivity to viewshed modification. The inventory unit for this RMP effort included the foreground-middle ground distance zone, as viewed from the riparian corridor. The public lands within this inventory unit were classified as visual resource inventory class II.

The visual resource management classes are assigned through decisions made in the RMP process. Visual resource management classes are determined with consideration for other natural resource values, land uses, and viewshed manageability. Land uses common to this inventory unit include light industrial, residential, commercial, agricultural, concentrated and dispersed recreation activities, and wildlife management. The objectives for visual resource classes are as follows:

- Class I: Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

- Class II: Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

- Class III: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract the attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

- Class IV: Provide for management activities which require major modification of the existing 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.

Watershed

The planning area is located in the upper reaches of the Columbia River Basin. The area includes approximately 23 miles of the Snake River, 4 miles of the Gros Ventre River, and associated wetlands.

Both rivers can provide sizeable amounts of water and sediment. The Snake River was traditionally a wide, sometimes braided channel with multiple overflow channels. The Jackson Lake Dam and the almost continuous levee system have altered the flow of water and sediment in the system to the point that the landform between the levees is rapidly changing. The levee system has reduced the river's access to many of its historic overflow channels. This has resulted in changes to the channel system, as well as changes in sediment and energy transport and distribution.

The Snake River Water Catchment above the confluence with the Gros Ventre River is larger and has a greater volume of flow than the Gros Ventre River (Table 3-8).

TABLE 3-8
WATER FLOW OF THE SNAKE AND GROS VENTRE RIVERS

USGS Water Monitoring Station	Water Catchment Area (mi^2)	Minimum Flow (Ft^3/sec)	Mean Flow (Ft^3/sec)	Maximum Flow (Ft^3/sec)
Snake River at Moose WY - #13013650	1,697	3,720	4,010	4,360
Gros Ventre at Zenith WY - #13015000	683	1.2	91	287

The Jackson Lake Dam, originally constructed in 1910-1911, provides some moderating influence on flow fluctuations in the Snake River. It can also maintain high flows for extended periods of time. The Gros Ventre River has few significant artificial flow restricting structures, and thus has a more variable, but lower total volume, flow. The effect that this difference has upon sediment transport is unknown at this time.

The Snake River channel primarily consists of material from glacial outwash deposits from the upstream portion of the Snake, and landslide material from the Gros Ventre and other landslides located along the two rivers.

Prior to 1955, there were a few short, unconnected levees along the Snake River. There were some minor bank structures as early as 1947. Between 1955 and 1964, about 13 miles of continuous levees were constructed. The levee system was expanded in later years and levee construction continues, although at a slower rate. Currently, the system encompasses about 20 miles of channel. Land use and property values have virtually assured the maintenance and expansion of the levee system in the future.

Analysis of pre-1955 photographs suggests that approximately 1/4 of the land that is currently within the levee system consisted of wooded islands. The percentage of wooded islands between the levees is considerably less at this time. Many of the islands have been completely removed while others are actively eroding. There is little evidence of island building.

Within the levee system, the average slope of the river is about 18 to 25 feet of channel drop per mile of channel length. Up and down stream from the levee system the river is less steep, with channel drops averaging between 13 and 22 feet per mile. This results in an overall greater amount of kinetic energy within the leveed portions of the channel.

The higher energies within the leveed reaches of the river have created an overall erosion of the stream channel. If the movement of material between the levees was uniform, the overall loss of material would be about 0.85 feet between 1954 (prior to major levee construction) and 1988.

The distribution of the material between the levees is not even. Some areas have dropped while others have gained in elevation. Some stream reaches have shown a fluctuation in the elevation of the deepest portion of the channel (thalweg) varying from 7 feet below to 9 feet above the 1954 survey level. There are theories for this uneven distribution of material, the most likely being constrictions within the channel restricting the flow of bedload material. Continued building up of the gravel substrate in some portions of the river could create a risk of floods or damage to

highway bridges. The channel's shape is still changing, so it is not known if the current patterns will remain constant over time.

As a result of the high bed load and high flows, the thread of the river tends to switch channels frequently. This, in combination with the artificially confined nature of the channel, has created some concern for the remaining islands within the levee system as well as for the stability of the levee system itself. The Snake River Restoration Project has been proposed by Teton County and the COE to help address this situation.

The BLM manages a relatively small amount of land within the Wyoming portion of the Snake River corridor. This, in combination with the high percentage of private land, the levee system, and efforts to manipulate the channel within the levees suggests that the overall effect on water quality from activities taking place on BLM managed lands is minor in comparison to the potential presented by the surrounding lands Recreation related activities and unauthorized dumping are the actions that are most likely to take place on BLM managed lands that could directly affect water quality. Sanitation facilities at key recreation sites and site visits to BLM parcels by land managers help to reduce negative impacts but cannot prevent all undesirable activities.

The Snake River on the BLM parcels was assessed for Proper Functioning Condition on August 15, 1996. On all parcels, the river was determined to be in nonfunctioning condition, primarily because the river levees prevent its access to its natural floodplain, prevent regeneration of the cottonwood stands along its banks, and channelize the flow.

The BLM parcels contain some lentic surface water features, such as oxbow lakes and wetlands, which have water tables closely tied to the stage of the river. These features are generally located away from the main recreation corridor. Within the levee system, movements of the main channel and efforts to restrain this movement can have a marked effect on the water quality of an individual water body through both erosion and stagnation behind newly constructed features. Given the comparatively small size of these water bodies, the effect that they have on water quality in the Snake River is most likely undetectable.

Water features that exist on BLM parcels outside of the levee system appear to have water levels closely tied to the level of the Snake River. Seeps and springs that have other water sources may exist but they are not immediately evident. Conditions of the water features outside the levees tend to be less disturbed than those within. Conditions also appear to be closely tied to the level of grazing and recreational activity associated with the area.

Wild and Scenic Rivers

Assessment of the parcels for eligibility and suitability under the Wild and Scenic Rivers (WSR) Act has been conducted. All the parcels on the Snake River were found to be eligible for inclusion in the WSR system, due to their importance for recreation and wildlife habitat and valuable scenic qualities. However, the parcels were not found suitable for inclusion in the WSR system, chiefly due to their small size and each parcel's orientation along one side only of the river, leading to difficulty of managing them as part of the Wild and Scenic Rivers system.

Wildlife and Fisheries

The ribbon of cottonwood riparian forest surrounded by sagebrush or open field creates extremely important habitat for a diversity of wildlife (Brinson, et al. 1981; Brockmann 1993; Cerovski, et al. 2001; Oneale 1993; Simpson, et al. 1982). The Snake River riparian corridor is a major migration route and breeding area for migratory songbirds and raptors (Minta and Campbell 1991a). The productivity of bald eagle (*Haliaetus leucocephalus*) nests along the Snake River is credited for the eagle recovery of the entire Greater Yellowstone region (Swenson, et al. 1986). This area is not identified as a major waterfowl flyway, though many species do nest or transition through the corridor (Bellrose 1976). The river corridor supports migration routes for elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*), as well as limited crucial winter range for these species and the moose (*Alces shirasi*). The planning area includes two elk feedgrounds. Teton County (1994) identifies a variety of wildlife as "Species of Special Concern (SSC)" from the investigation conducted by Biota Research and Consulting, Inc. (Minta and Campbell 1991a,b). Some of these species are considered because of their dependence on the river for survival (obligates), others are chosen due to their use of a habitat that provides a range of desired conditions, i.e., cover, forage, a zone free of human disturbance or influence.

The wildlife resources are dependent on a functioning environment, which provides all of the elements for survival in the proper balance, and the riparian system is considered the most valuable (Bull 1977; Carothers and Johnson 1975). Human activities, i.e., "channel alteration, ground water pumping, surface diversion, impoundment, direct removal of riparian vegetation, alteration of flooding regimes, and urbanization...contaminants, recreation, grazing, and habitat fragmentation..." are having a detrimental impact to the riparian corridors of the Snake River which is resulting in degradation and losses of wildlife habitats (Cerovski, et al. 2001; USFWS 1986b, 1992). The current levee system has resulted in a reduction in riparian/wetland habitats, which in turn is changing the composition of species (UW undated). Key to the survival of all the wildlife species that use the Snake River corridor for some or all of their life-cycle is the need for protection from encroachment by human factors, i.e., direct presence (close interactions, pets, off-road vehicle use), and human-made altering of the habitat (levees/channelization, fences, vegetative manipulations-tree/snag removal) (Bull 1977; Cerovski, et al. 2001; Edwards 1978; Minta and Campbell 1991a,b; Olendorff and Kochert 1992; Teton County 1994). The relationship of healthy, productive and diverse wildlife populations to their habitats is specifically recognized in the WGFD Strategic Plan (WGFD 1998). Within "Goal 1" of this Plan is the intent to "maintain and enhance terrestrial wildlife habitats...[and] minimize loss of habitats through protection...."

Terrestrial Resources - Avian

Over 400 avian fauna species have been documented in Wyoming, and 73 of these use riparian habitats (Cerovski, et al. 2001). GTNP reports over 300 species of birds within its boundaries (NPS 1997). GTNP has been "accepted, contacted but permission pending" for inclusion in the National Audubon Society's Important Bird Area program which is confirmation of the avian values associated with the Yellowstone/Jackson ecosystem. The variety of birds throughout the planning area exceeds 150 species. Nearly 80% of these species breed along the Snake River corridor. The remaining species make use of the cottonwood-riparian habitat type for foraging and as an interlude on the spring and fall migrations, and some can be found as winter inhabitants. The vast majority (75%) of the avian species are classified as passerine or songbirds and over half of these are considered year-round residents (USFWS 1990, 1991, 1992). The

cottonwood-willow dominated lands of the riparian corridor are critical to sustaining avian biodiversity (Finch 1986; USFWS 1990). Degradation in the quantity and quality of avian habitats, principally riparian types, has led to declines in species diversity on a national scale (Olendorff and Kochert 1992; Pashley, et al. 2000). USFS (undated) notes that "24 of 53 avian species listed in the "'blue list"' were recorded during the summer of 1977 along the Snake River." This "blue list" is identified as a nationwide listing of birds with evidence of "population declines" as reported by the Audubon Society in the Journal of American Birds.

Protection for most avian species comes under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711)(CFR 2001). Adherence to the MBTA and participation in various avian conservation programs was emphasized in Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds (66 FR [Federal Register] 3853)*, dated January 10, 2001. Federal agencies are directed to focus on such things as restoring and enhancing habitat as well as avoiding or minimizing adverse impacts to migratory bird populations.

Raptors find the habitat along the Snake River corridor an ideal area for seasonal use, migration interludes and year-round dwelling (USFWS 1992). The foraging opportunities are plentiful for species that rely on a diet of fish, waterfowl, or small animals that occupy the riparian habitat. The cottonwood canopy provides excellent perching and nesting sites, and the heavier vegetated areas limit the amount of human disturbance. In the food-chain hierarchy, raptors are considered at the top among avian species and are a representative indicator species of environmental condition (USFWS 1999). "Habitat is the key to managing raptor populations!" (Olendorff and Kochert 1992). Protecting nesting habitat and ensuring an adequate, "uncontaminated" food supply is crucial to sustaining a raptor population (Redig 1979). Raptors that utilize the Snake River corridor include: falcons - American kestrel (*Falco sparverius*), merlin (*F. columbiaris*), prairie falcon (*F. mexicanus*), and the peregrine falcon (*F. peregrinus*); hawks - red-tailed (*Buteo jamaicensis*), Swainson's (*B. swainsonii*), sharp-tailed (*Accipiter striatus*), Cooper's (*A. cooperi*), and northern goshawk (*A. gentilis*); and owls - the western screech-owl (*Otus asio*), great horned owl (*Bubo virginianus*), long-eared owl (*Asio otus*), and northern saw-whet owl (*Aegolius acadicus*), and the great gray owl (*Stix nebulosa*) (COE 1989; USFWS 1990, 1991).

The fish-rich Snake River system provides an ideal habitat for the fish-dependant osprey (*Pandion haliaetus*). This species in particular finds the partially dead or dead-standing trees along the river readily available for nesting and perching, though snags are valuable habitat components for other wildlife species (Bull 1977; Brockmann 1993; Miller 1977). Artificial nesting structures have been located along the river that serve as alternate, as well as convenient, nesting sites. The dependence of the osprey on the river system for most phases of its life cycle is complicated by its vulnerability to human disturbance during nesting, incubation and the early nestling period. The impact seems to depend on the timing and frequency of human activity, and the degree to which the osprey habituate to the disturbance early in the mating cycle (Zarn 1974).

Golden eagles (*Aquila chrysaetos*) and the federally threatened bald eagle (see Threatened and Endangered section) are year-long residents. Golden eagles are observed more often outside of the flood plain, while bald eagles use the riparian corridor extensively for nesting, perching and feeding (USFWS 1990, 1991).

The Snake River and its tributaries are prime habitats for resident and migratory waterfowl during spring/fall staging, breeding, nesting, brood rearing, and wintering (Fralick 1989). Duck species

include the dabbling ducks: mallard (*Anas platyrhynchos*) and American widgeon (*Mareca americana*); and the sea ducks: Barrow's goldeneye (*Bucephala islandica*), common goldeneye (*B. clangula*), ring-necked duck (*Aythya collaris*) and hooded merganser (*Lophodytes cucullatus*) (USFWS 1991). Canada geese (*Branta canadensis*) find the islands along the Snake River that are not subject to inundation by high water to provide nesting habitat among log debris and willows, while affording protection from some predators (USFWS 1990). The most important nesting areas for Canada geese on the Snake River are south of the Wilson Bridge to the South Park Bridge, with an average of 2.0 pairs per mile (COE 1989; Fralick 1989; USFS undated; USFWS 1991). This area is a major fall staging and migration route (USFWS 1990). The North American Waterfowl Management Plan (NAWMP) (USFWS 1986a) states that habitat conservation, maintenance and improvement are imperative to succeed with the goals of the Plan. The overall North American population trend for waterfowl is showing a positive response (increasing or stable) to the management strategies of the NAWMP. By monitoring the population trends in specific wetland areas, it may be possible to detect factors that are or could adversely affect waterfowl, as well as other wildlife (USFWS 1998b).

Wading birds observed in the planning area include the greater sandhill crane (*Grus canadensis*) and the great blue heron (*Ardea herodias*). Both species utilize beaver ponds and seasonally flooded emergent wetland habitats; cranes use these areas as suitable nesting habitat, and herons for a varied available diet of aquatic insects, amphibians, reptiles and small mammals (USFWS 1990, 1991). The surrounding hay meadows provide cranes with foraging areas. The southern planning area serves as a staging area for the crane's fall migration, and as a spring migration stopover. The National Elk Refuge (NER), which adjoins the planning area, serves as a "major staging area" (USFWS 1990). The largest Wyoming great blue heron rookery is located in the South Park area (COE 1989; USFWS 1990). Freedom from human disturbance and sustained foraging areas are critical to maintaining a heronry (Minta and Campbell 1991b). Heron overwintering may occur in the planning area (USFWS 1990, 1991).

Terrestrial Resources - Mammals

Populations of some small mammals are cyclic in nature, with densities varying by season. However, if sufficient habitat is available, populations are relatively high (Clark and Stromberg 1987). Diversity in vegetative cover-types found in viable riparian systems provides a preferred habitat for small mammals (Snyder 1980). Predators in the area, such as hawks, owls, long-tailed weasels (*Mustela frenata*), red fox (*Vulpes vulva*), bobcat (*Lynx rufus*), and coyote (*Canis latrans*) all prey on these small mammals.

The small mammal group includes the bats. Four species found in the planning area include the hoary (*Lasiurus cinereus cinereus*), the silver-haired (*Lasionycterus noctivagans*), the long-eared (*Myotis evotis evotis*), and the little-brown (*M. lucifugus carissima*). The abundance of insects along the riparian bottoms makes for a reliable food source for bats (USFWS 1990, 1991).

Furbearers found in the planning area include the mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), and beaver (*Castor canadensis*). Mink densities are low in the planning area. Muskrats inhabit ponds, oxbows, and spring creeks, and feed on aquatic vegetation. Their population numbers generally have not been considered a threat to maintaining wetland habitat in Wyoming (Oneale 1993). This species is a harvested furbearer within and adjacent to the planning area (USFWS 1991).

The Snake River is identified as one of the most significant areas in Wyoming for the river otter (Rudd, et al. 1986; USFWS 1991), as it provides excellent denning (stream banks, beaver lodges, log jams and piles) and foraging habitat (pools and oxbows) with adequate populations of fish. Those reaches of the Snake River that are constrained by levees do not provide suitable otter habitat (COE 1989), thus the tributaries and areas free of human disturbance are more common locales (GTNP 2000b). Alterations in habitat, including "development of waterways for recreational or industrial uses" can adversely impact otter populations (NYROP 1984). Otters are protected by State law and are not harvested.

Beavers principally inhabit river tributaries, side channels and oxbows. They utilize the cottonwoods outside of the levee-system for constructing lodges and dams, while relying on the willow-shrub understory for food. Beaver activity has improved riparian/wetlands by retarding the effects of flood control projects. Where beaver ponds are created, there is an increase in wildlife biodiversity when the shrub and other riparian vegetation components are established (Olsen and Hubert 1994). This furbearer is harvested, with the annual take being controlled by the WGFD.

The elk population in the Jackson Hole area (which includes YNP) is one of the largest in North America, with a summer population up to 15,000 elk that inhabit over 1,000 square miles (COE 1989; USFWS 1990, 1991). Portions of the herd summer in southern YNP, then migrate south as far as 60 miles to their winter range (Clark 1981). The planning area north of the Wilson Bridge lies within the WGFD Jackson Elk Herd Unit (JE) while the area to the south is within the WGFD Fall Creek Elk Herd Unit (FCE). These herd units consist mostly of large areas outside the planning area. With the recommendations from the WGFD, the Wyoming Game and Fish Commission sets big game population and annual harvest objectives. The elk herd population objective for JE is 11,029 animals, and the estimated post-2000 hunt population was 14,300 (WGFD 2001). The number of elk from the JE that use the planning area is low during the spring to fall seasons. The principal activity comes during the migration across parcels adjacent to GTNP en route to and from the National Elk Refuge, which provides both natural and enhanced winter range with supplemental feeding over its 24,000 acres (USFWS 1991). Approximately one-quarter of the FCE inhabits the WGFD South Park Habitat Unit. The planning area south of the Wilson Bridge has some elk that summer primarily on private lands, but the principal summer range lies to the west in the surrounding mountains (USFWS 1991). The FCE objective is 4392 animals, with the estimated population at 4849, post-hunt 2000. The South Park elk feedground falls within the FCE (quota: 1000) and 1,112 animals were counted in 2000 (WGFD 2001). Elk move to the South Park feedground using BLM parcels south of the Wilson Bridge (Andrews 2000, personal observation). Elk parturition on BLM parcels in the planning area is not documented.

Moose are found throughout the Snake River planning area in the WGFD's Jackson Moose Herd (north of the Wilson Bridge) and Sublette Moose Herd (south of the Wilson Bridge) Units (JM and SM, respectively). There is a year-round population of moose in the river and creek bottoms, which increases during winter as moose migrate from the National Parks and surrounding National Forest land (NPS 2000). The WGFD has designated portions of each of these herd units as crucial winter range (Map 17). The JM population objective is 3,600 moose. Because only a small portion of the SM falls within the planning area, it is not feasible to assign a population objective over this segment. However, the number of moose that use this stretch of the Snake River varies from 15-30, depending on the forage demand and winter conditions (Fralick 2002,

personal communication). Moose densities (1982-89) range from 4.3 per mile in the SM to 6 per mile in the JM (USFWS 1990, 1991).

Mule deer herds in the planning area include the Jackson Deer Herd Unit (JD) which is north of Wilson Bridge and the Sublette Deer Herd Unit (SD) to the south. Most of the seasonal use is spring, summer and fall in both units (COE 1989; USFWS 1990). Only a small area in the JD includes designated crucial winter range (Map 17). Wintering areas outside of the planning area include the traditional west-facing slopes. The SD within the planning area contains very little crucial winter range, as the winter range for these deer is in the Green River basin; however, a few animals have been observed to over-winter (USFWS 1990; WGFD 2001). Mule deer migration patterns exhibit a movement through the planning area to winter ranges on the east side of the Snake River (USFWS 1991).

Some white-tailed deer (*O. virginianus*) have been observed in the Snake River drainage but their numbers are low and the animals are widely dispersed (USFWS 1990, 1991).

Pronghorn antelope (*Antilocapra americana*) are not a common animal within the planning area. They use the flood plain and sagebrush benches of the Upper Snake River drainage, outside the planning area, during the summer (USFWS 1990).

Bison (*Bison bison*) in the Jackson Bison Herd (JB) inhabit the NER and uplands of GTNP. The JB management population objective is 400 animals (winter population). The population in this herd was 552 during the winter of 2000-2001 (WGFD 2001). Bison would probably not be affected by this management plan.

Bighorn sheep (*Ovis canadensis canadensis*) seasonal ranges lie outside of the planning area (WGFD 2001; USFWS 1990). The Jackson Bighorn Sheep Herd Unit would not be affected by this management plan. Big game crucial winter ranges are shown on Map 17.

Black bears are intermittent users in the planning area, principally in areas adjacent to GTNP were there is a lower level of human disturbance (Minta and Campbell 1991b). Mountain lions are not likely users of the BLM parcels; they are rare in GTNP, even in the appropriate habitat (GTNP 2000a). However, lions are present on the NER and occasionally in or near the town of Jackson. The actions of this management plan would not affect these species due to the diversity and size of their home ranges.

Terrestrial Resources - Amphibians and Reptiles

Forty-two varieties of amphibians and reptiles have been noted in Wyoming (Baxter and Stone 1980). Only a few have geographic ranges into the planning area: tiger salamander (*Ambystoma tigrinun*), Western (boreal) toad (*Bufo boreas boreas*), northern leopard frog (*Rana pipiens*), Columbia spotted frog (*R. luteiventris) [previously known as the spotted frog* (*R. pretiosa*)], boreal chorus frog (*Pseudacris triseriata maculata*), wandering garter snake (*Thamnophis elegans vagrans*), valley garter snake (*T. sirtalis fitchi*), rubber boa (*Charina bottae*), and bull snake (*Pitophis melanoleucas*) (NPS 1997; USFWS 1990, 1991; Van Kirk, et al. 2000). As identified in Van Kirk, et al. (2000), "Amphibian population distribution and abundance may

shed light on the health and connectedness of GYE [Greater Yellowstone Ecosystem] wetlands and riparian habitats."

Fisheries

The Snake River through Jackson Hole is designated as a Class 1 or blue-ribbon trout stream by the WGFD. This designation indicates that the river is of national importance as a trout stream. Among the many game and nongame fish species present, the indigenous fine-spotted cutthroat trout (*Oncorhynchus clarki* ssp.2) is economically the most important species, as it is the major game fish sought by anglers in the Snake River. The fine-spotted cutthroat trout is a self-sustaining (naturally reproducing) subspecies found only in the Snake River drainage from Palisades Reservoir in Idaho, upstream to the headwaters in YNP. This wild stock maintains its current population by spawning in suitable habitat, regionally known as "spring creeks," without stocking of juvenile or adult fish to the river system. This trout supplies the major sport fishery in the Snake River, from Jackson Lake Dam down through the canyon area of the Snake River above Palisades Reservoir. Butler Creek, a spring creek, crosses BLM parcel 23.

Spawning, rearing, and overwintering habitat are considered to be the major limiting factors for fine-spotted cutthroat trout. Most fine-spotted cutthroat trout spawning occurs during the period from March through June in the spring creeks that enter the river. Openings to many of these spring creeks are currently blocked by levees, making them inaccessible to the fish. Little or no spawning habitat exists in the main river due to large sediment bedloads and turbidity in the springtime flows (during the spawning period), human-induced modifications to the channel, and a cobble substrate that is typically too large for fine-spotted cutthroat trout spawning. Sloughs and side channels are important sources of rearing and overwintering habitat, particularly for young age classes of fine-spotted cutthroat trout.

The once braided, multi-channel system with its diverse adjacent habitats has been replaced with a single or double channel and cobbled shoreline. The value of the shoreline and the diversity of the braided river channel has changed significantly. As the leveed reach has become increasingly less diverse, overwintering habitat has become a significant limiting factor for some species. Survival through the harsh low-flow winter months is a critical life cycle period. Harsh winter temperatures and low flows limit fine-spotted cutthroat trout survival. During the winter months, trout can survive only in pools that provide protection from ice and predators. Winter predators such as bald eagles, river otters, and fish-eating waterfowl can easily prey on the trout within their restricted areas of habitation.

Other trout species found in this region of the river are less abundant. They include brook (*Salvelinus fontinalis*), rainbow (*Oncorhynchus mykiss*), brown (*Salmo trutta*), and lake (*Salvelinus namaycush*) trout (which may pass through Jackson Lake Dam). Another game species that is apparently abundant but little utilized by anglers is mountain whitefish (*Prosopium williamsoni*).

Nongame fish species include suckers (an important food source for bald eagles), and five species of the minnow (Cyprinidae) family. These include Utah suckers (*Catostomus ardens*), redside shiners (*Richardsonius balteatus*), and sculpins (*Cottus* spp.). Small fish may be used as prey by fine-spotted cutthroat trout.

Levee construction and other human activities have led to significant decreases in the amount and quality of spawning, rearing, and overwintering habitat for aquatic species. Increases in these resource types will be needed to promote the future viability of game and nongame fish.

Threatened and Endangered Species

Threatened and Endangered Species are protected under the Endangered Species Act of 1973 (16 U.S.C. [United States Code] 1513 *et seq*.), as amended. In accordance with the Code of Federal Regulations (CFR), 50 CFR 17, the Canada lynx (*Lynx canadensis*) is listed as a Federally Endangered species; the grizzly bear (*Ursus arctos horribilis*) and the bald eagle are listed as Federally Threatened species; the whooping crane (*Grus americana*) and the gray wolf (*Canis lupus*) are listed as Federally Endangered and Federally Threatened "nonessential experimental populations," respectively.

The presence of Canada lynx is not expected in the planning area due to the lack of suitable habitat (spruce/fir/late-seral conifer forest on slopes of 8-12 degrees), poor abundance of its principal prey species (the snowshoe hare [*Lepus americanus]* and red squirrel [*Tamiasciurus hudsonicus]*) and the high level of human disturbance (Beauvais, et al. 2001; NPS 2000; Ruediger, et al. 2000). A single, radio-collared lynx (now deceased) had been documented to travel the area from the northern Bridger-Teton National Forest to the lower extent of the Wyoming Range but his location on parcels in this management plan is not confirmed (Laurion and Oakleaf undated). The USFWS issued a Biological Opinion on October 25, 2000, regarding the effects on Canada lynx of BLM land use plans. For those existing plans, the determination was that no actions were "likely to jeopardize the continued existence of the lynx." The alternatives in this management plan are not expected to alter that determination.

The grizzly bear recovery zone, now identified as the "Primary Conservation Area" lies beyond the planning area (USFWS 1990, 1991, 2000). Due to the general lack of suitable forage in areas also free of high human disturbance, it is not anticipated that grizzly bears will inhabit the limited areas covered by this management plan (COE 1989; Moody, et al. 2002). In accordance with 50 CFR 17, if a grizzly bear encounter poses an immediate human threat, then the offending bear may be taken; actions other than killing may be required when the threat is not "immediate."

Special protection is afforded the bald eagle through the Bald Eagle Protection Act (16 U.S.C. 668-668d). Bald eagle reproduction along the Snake River corridor has been exceptional, with one area in the management plan being identified as "some of the most important eagle habitat on the entire upper Snake River" (WGFD 1993). From 1982-88, 6 bald eagle pairs located on the Snake River between Moose and the South Park bridge produced 50 young, or 41 percent of the total production (Minta and Campbell 1991b; Swenson, et al. 1986). Under the Pacific Bald Eagle Recovery Plan (USFWS 1986b) the Upper Snake River (WY) Key Area is within Recovery Zone 18, which contained 17 nesting territories and a wintering population of 40-60 birds. The availability of food early in the nesting season, tree size in relationship to the surrounding trees, and areas where the river lacks restriction are factors in nest area selection (Swenson, et al.1986; USFWS 1986b, 1990, 1991). Human disturbance is known to affect the entire nesting chronology: nest tree selection, nest building, breeding, egg laying and incubation, brood rearing and fledging (GYBEWG 1996; Harmata 1989; Swenson, et al. 1986; USFWS 1986b). Fall and winter use includes both resident bald eagles and an influx of migrants (NPS 2000). Bald eagle food habits are highly dependent on the availability of fish, which account for over 60 percent of

the annual diet (Harmata 1989; Swenson, et al. 1986). This food abundance also impacts reproductive success (GYBEWG 1996). Foraging success is influenced by the condition of the river (water turbidity, velocities), the quantity of fish occupying accessible river reaches, and the level of human disturbance on the river (floaters/rafters and those fishing) (Stalmaster 1976). Other food sources include ungulate carrion during the winter, and waterfowl during the spring runoff (COE 1989; Swenson, et al. 1986; USFWS 1986b).

The USFWS has determined that no whooping cranes remain from the Grays Lake experimental flock (Alex Schubert, pers. comm. 2003)

The gray wolf has been observed on the NER. Two monitored wolf packs are located east of the planning area on the Gros Ventre River and the northeastern corner of GTNP. Based on the occurrence of wolves following and killing elk on winter feedgrounds (USFWS, et al. 2002), it is possible that wolves could travel through some of the management parcels to reach either the NER or the WGFD South Park elk feedground. Nearly 90 percent of the wolf diet in this area is reported as elk. In accordance with 50 CFR 17.84, actions to control, or take, wolves in this population are specifically limited (USFWS 1998a). Based on the success of the wolf introduction program it is possible that the USFWS may consider "delisting" in 2003 (USFWS, et al. 2002).

BLM Sensitive Species List

In April 2001, BLM Wyoming prepared a Sensitive Species List and guidance for inclusion of these species "when undertaking actions on public lands" (BLM 2001). The intent of this List is to "ensure actions authorized, funded, or carried out by BLM do not contribute to the need for any species to become listed as a candidate, or for any candidate species to become listed as threatened or endangered." This List is in compliance with BLM Manual 6840, Special Status Species Management, Release 6-121, January 19, 2001. Species on this list which might occur in the area of this plan include Mammal: long-eared myotis; Birds: trumpeter swan, northern goshawk, peregrine falcon, yellow-billed cuckoo (*Coccyzus americanus*) and loggerhead shrike (*Lanius ludovicianus*); and Amphibians: northern leopard frog and Columbia spotted frog (listed as spotted frog) (BLM 2001; USFWS 1990). Also on the list of species in the area of the Snake River corridor and the BLM's Sensitive Species List are the ferruginous hawk (*Buteo regalis*) and Brewer's sparrow (*Spizella breweri*) (USFWS 1990). However, the appropriate habitats for these two species are not believed to occur in the planning area.

Trumpeter swans (*Olor buccinator*) are common winter residents in the planning area (USFWS 1990). Crucial winter habitat for trumpeter swans is primarily located downstream from the Wilson Bridge. The spring fed tributaries and wintering areas (South Park, Fish Creek, and Lower Flat Creek) account for nearly 35 percent of the swan winter-use areas, with Fish Creek being the prime location (USFWS 1990, 1991; WGFD 1993). The planning area and surrounding river corridor areas included within GTNP do not provide suitable nesting habitat for swans (COE 1989; NPS 1997).

The yellow-billed cuckoo is a candidate species for listing under the Endangered Species Act (65 *FR* 8104). Breeding has been documented in GTNP and the cottonwood-willow riparian corridor of the Snake River is suitable breeding habitat. However, selection of an area may depend on size (to as large as 100 acres) and an adequate food supply. Fragmentation of the cuckoo's

habitat is a serious problem (Hughes 1999). The western United States population is being adversely impacted by a loss of riparian breeding habitat (USFWS 2001).

Information on the Snake River fine-spotted cutthroat trout (*Oncorhynchus clarki* ssp[2]) is found in this chapter under the "Fisheries" section.

Human-Wildlife Interaction

Within the scope of the RMP is the goal to provide a quality recreational experience while protecting the varied wildlife and fragile habitats. Human-wildlife conflicts sometimes occur. In cases where these interactions pose a threat to human health and safety, it may be necessary to involve the WGFD or the USDA-Animal and Plant Health Inspection Service-Wildlife Services (WS) office to rectify the situation. The BLM and WS have a Memorandum of Understanding (MOU), dated April 3, 1995, to address potential conflicts. The MOU is updated through an annual Work Plan (WS and BLM 2002). The BLM parcels occur within designated Human Safety Zones as identified in the Work Plan, thereby restricting corrective measures to emergency situations. WS also has agreements with the WGFD and USFWS to take the actions necessary when human health and safety are a concern in dealing with predators or threatened and endangered species (WS and BLM 2002). Whenever possible, a non-lethal resolution to the conflict is the preferred outcome.